Photography copyright: Sami Paakkarinen 2012

USER INSTRUCTIONS
JJ-CCR Rebreather

(CE Version 1.00 / Revision 04)

Reproduction and changes of this document and its content is prohibited without written approval from JJ-CCR ApS.

All information in this document has been carefully analyzed and is believed to be accurate. However, it is not possible to guarantee its accuracy and all liability is excluded. Cited companies and/ or product names are trademarks belonging to the respective companies.

General cautionary notes and warnings

- Never use the JJ-CCR Rebreather without receiving specific equipment training (basic course or crossover).
- These user instructions do not replace training with the equipment and are not directions for diving with closed circuit equipment.
- As with other equipment, it is possible that a Rebreather may fail at any time! It is therefore essential that an autonomous bailout system, independent of the equipment, be taken by the diver on every dive. The bailout system must be configured such that the dive can be terminated without difficulty in the event of a malfunction.
- Your knowledge and practical exercises are the best prerequisites for avoiding accidents.
- Modifications to the equipment result in the CE being voided immediately and it is no longer possible to guarantee a safe dive. This is also the case in the event of a failure to observe the service and maintenance intervals.
- Modifications to the equipment result in the warranty being invalidated. If modified equipment and/or parts are returned for repairs or maintenance then the equipment will be restored to its original format in the factory. Any parts and work required in order to do so will be billed for.
- Replacement parts, repairs and maintenance may only be carried out / shall only be supplied if the owner is able to provide verification that he possesses the requisite equipment-specific training.
- It is highly recommended that the user take the time to read through these user instructions in full.
- If you do not concur with the warnings provided then you should not dive with a JJ-CCR Rebreather.

Content

1	**Table of contents**	**3**
1.1	Revisions and change documentation	6
2	**Introduction**	**7**
3	**JJ-CCR overview**	**8**
3.1	Scope of functionality	8
3.2	Technical specifications	9
4	**Assembly of the JJ-CCR**	**10**
4.1	Base unit	10
4.2	Handle	11
4.3	Stand	11
4.3.1	Attaching the stand to the base unit	12
4.4	1st Stages and hoses	13
4.5	Wing	14
4.6	Back-mounted counter lungs (BMCL)	14
4.7	Back plate and harness	15
4.7.1	Adjust the harness	16
4.8	Connecting the supplemental oxygen valve	17
4.9	ADV connection	17
4.10	Soda lime canister (axial)	18
4.11	Soda lime canister (radial)	19
4.12	Lid	20
4.13	Breathing hose with DSV (Dive Surface Valve)	22
5	**Main components**	**23**
5.1	Lid	23
5.1.1	Battery compartment	23
5.1.2	Oxygen sensors	24
5.1.3	Solenoid	24
5.1.4	Breathing hoses	24
5.2	Controller	25
5.3	HUD (Head Up Display)	25
5.3.1	HUD calibration	26
5.3.2	Reading the HUD	26
5.4	ADV (Automatic Diluent Valve)	27
5.5	Manual supplemental oxygen valve	27
5.6	Manual supplemental diluent valve (optional)	27
5.7	DSV (Dive Surface Valve)	27
6	**Controller**	**28**
6.1	Overview	28
6.2	Functionality	29
6.3	Switching on the controller	30
6.4	Left and right buttons	30
6.4.1	Left (MENU)	30
6.4.2	Right (SELECT)	31
6.4.3	Overview of the button functions	32
6.5	The main display	32
6.6	Menu structure	34
6.7	Menu reference	35
6.8	Turn Off	35

6.9 Calibrate (calibration of the 02 sensors) 36
6.9.1 PP02 monitoring 37
6.9.2 Checking calibration during a dive 37
6.10 End Dive 38
6.11 Switch Setpoint 38
6.12 Select Gas 38
6.13 Switch OC/CC (between open/closed circuit) 39
6.14 Dive Setup+ 40
6.14.1 Low SP (low setpoint) 40
6.14.2 High SP (high setpoint) 41
6.14.3 Define Gas 41
6.14.4 Dive Planner 43
6.14.5 Conserv. (Conservatism) 46
6.14.6 NDL Display (GF99, CEIL, NDL or @+5 display) 47
6.14.7 Brightness 49
6.15 Dive Log+ 49
6.15.1 Display Log 50
6.15.2 Upload Log 50
6.15.3 Edit Log Number 51
6.16 Setpoint -> .19 51
6.17 System Setup+ 52
6.17.1 Dive Setup (overview) 52
6.17.2 Low Setpoint (Dive Setup) 52
6.17.3 High Setpoint (Dive Setup) 53
6.17.4 NDL Display (Dive Setup) 53
6.17.5 Deco Setup (overview) 53
6.17.6 Conserv. (Deco Setup) 54
6.17.7 Last Stop. (Deco Setup) 54
6.17.8 Gas On/Off. (Deco Setup) 55
6.17.9 OC Gases 56
6.17.10 CC Gases 57
6.17.11 O2 Setup (overview) 59
6.17.12 Cal. FO2 (O2 Setup) 59
6.17.13 Solenoid (O2 setup) 60
6.17.14 Auto SP Switch 60
6.17.15 Display Setup (overview) 61
6.17.16 Units (Display Setup) 61
6.17.17 Brightness (Display Setup) 62
6.17.18 Altitude (Display Setup) 62
6.17.19 Flip Screen (Display Setup) 62
6.17.20 System Setup (overview) 63
6.17.21 Date (System Setup) 63
6.17.22 Time (System Setup) 63
6.17.23 Unlock (System Setup) 63
6.17.24 Load Upgrade (System Setup) 64
6.17.25 Reset to Defaults (System Setup) 64
6.17.26 Advanced Config (overview) 64
6.17.27 Salinity (Advanced Config 1) 64
6.17.28 Title Color (Advanced Config 1) 65
6.17.29 OC Show PPO2 (Advanced Config 1) 65
6.17.30 End Dive Delay (Advanced Config 1) 65
6.17.31 Advanced Config 2 (overview) 66
6.18 Status information 67
6.19 Alarm and error messages 70
6.20 Changing the batteries 75

6.21	Firmware Update	76
6.22	Step-by-Step Firmware Update	77
6.23	Startup Text	79
7	**VPM-B /VPM-GFS decompression model**	**80**
7.1.1	Deco Model	80
7.1.2	Conserv. (VPM)	80
8	**Checklist prior to diving**	**81**
8.1	Preparations on land	81
8.2	Shortly prior to diving	82
8.3	Shortly after entering the water	82
9	**Diving**	**83**
10	**After the dive**	**83**
11	**Cleaning**	**83**
11.1	"Quick" cleaning	83
11.2	"Complete" cleaning	84
12	**Storage**	**84**
13	**Maintenance**	**85**
13.1	General Care	85
13.2	Maximum service life	85
13.3	Approved care products	85
13.4	Care Intervals	86
13.4.1	Prior to every dive	86
13.4.2	After every dive	86
13.5	Maintenance intervals	86
13.5.1	Every 12 months	87
13.5.2	Every 24 months	87
13.5.3	Every 60 months	87

1.1 Revisions and changes in documentation

Revision	Description
00	CE Version
01	- Data for axial soda lime canister (100m) added - Some minor corrections
02	- Firmware 42 - Some minor corrections
03	- Re-design of document structure - Some minor corrections
04	- Firmware 46

2 Introduction

Congratulations on purchasing the JJ-CCR Rebreather. We are certain that you will experience many unforgettable dives using this equipment.

The development and testing of the JJ-CCR Rebreather started back in 2006. During this period the equipment was able to demonstrate exceptional reliability over more than 1500 diving hours at a wide range of locations around the world. The product development philosophy is aligned with the following criteria:

- Strict application of the KISS principle: "Keep It Simple Stupid"
- The Rebreather must be extremely solid, multifaceted and reliable
- The Rebreather must be very simple to use, maintain and service
- The use of easy to obtain parts, enabling on-site repairs at any time.
- The support of a wide range of tank sizes without requiring any special adjustments to the equipment.
- The supply of fully operational equipment and not basic equipment with numerous different options.
- The equipment must be configured to include a very high level of redundancy. For example, separate batteries for the controller, HUD and solenoid. No batteries are permitted within the circuit. And it must be possible at all times to manually operate the Rebreather in the event of the controller failing.
- The use of simple and above all reliable electronics. No use of any high tech gimmicks and strict avoidance of an "autopilot effect". The diver retains full control of the Rebreather and not vice versa.
- Availability of scientific test records in order to verify the equipment performance.
- Always on the search for new ways of further improving the equipment.

3 JJ-CCR overview

3.1 JJ-CCR Scope of functionality

- Highly robust aluminium housing to which it is possible to secure up to 4 diving tanks (2 – 12 litre) using conventional tank belts.
- Self-filling soda lime canister (axial or optionally additionally radial)
- Heavy duty stand
- Integrated handle
- Back-mounted counter lungs
- Redundant power supply: One battery for the controller, one battery for the HUD and two parallel batteries for the solenoid. None of the batteries are integrated into the circuit.
- Integrated ADV (Automatic Diluent Valve)
- DSV (Dive Surface Valve)
- Valve for manual oxygen feeding with the option of feeding in external gases - also optional for the diluent
- Independent HUD (Head Up Display) with real-time display of PPO2 for all three oxygen sensors
- Reliable controller with an integrated multi-gas decompression computer (based on the Shearwater Predator)

3.2 Technical specifications

Dimensions	70cm x 40cm x 26cm including the handle
Weight	34.2kg – Ready for operation with 2 x 3 litre tanks 19,8kg – Without tanks and soda lime
Soda lime canister	Type: Axial (standard) Soda lime: 2.3kg (Sofnolime 797) Running time: 120 min at a constant depth (40 m) 180 min with dive profile (40 m) 150 min with dive profile (100 m) Type: Radial (optional) Soda lime: 3.05kg (Sofnolime 797) Running time: 180 min with dive profile (100m) Dive profile: (40 m) 40 min at 40 m, 5 min at 15 m, 9 min for the remaining time Dive profile: (100 m) 10 min at 100 m, 2 min at 40 m, 2 min at 15 m, 9 m for the remaining time Test parameter: 40l/min air, 1.6l/min CO2, 4°C water temperature
Batteries	2 x 3.6v lithium (SAFT 14500). One battery for the controller and one battery for the HUD. 2 x 6v lithium (Energizer CR-P2). (Parallel operation for the solenoid)
Volume of the counter lungs	8 litres
Maximum application depth	Max. 40 m with air as diluent Max. 100 m with trimix as diluent **Warning:** Dives exceeding a depth of 100 m are associated with numerous additional risks
Purity of the gases	Air: DIN EN 12021 Oxygen: >99.5% (medicinal oxygen) Helium: >99.996
Atmospheric pressure range	800 – 1050mbar
1st stage "oxygen"	Connection: M26x2 - medium pressure: 7.0 to 7.5 bar
1st stage "diluent"	Connection: DIN 5/8"- medium pressure: 9.0 to 10.0 bar
Oxygen control	Two oxygen setpoints (low and high). Can be switched as many times as required, also changeable under water.
Oxygen setpoint range	From 0.4 to 1.5 bar (low and high)
Oxygen warnings	Low 0.4 bar High 1.6 bar
Oxygen sensors	3 galvanic cells (type: R17JJ-CCR)
Operating temperatures	When diving: +4°C to +34°C Short-term (air): -10°C to +50°C Long-term (storage) +5°C to +20°C

4 Assembly of the JJ-CCR

This chapter deals with the basic assembly of the JJ-CCR Rebreather. The equipment is fully assembled at the time of delivery. This chapter is primarily intended to show how the basic assembly takes place. At the same time, it acts as a guideline for correctly reassembling the equipment if it proves necessary to disassemble it for any reason (e.g. transportation for a dive trip).

4.1 Base unit

The base unit of the JJ-CCR consists of a highly stable aluminium housing. The guide rails shown in the image hold the selected diving tanks in the correct position and they are also used to attach the tank belts.

On the front side it is possible to see two screw retainers and a tube on both the right and left hand side respectively.

The following image shows how the screw (lock screw M8x30) is inserted in the screw retainer. Both screw retainer openings are arranged such that an unintentional loosening of a connection will not result in the base unit falling off. The plastic section of the screw forms a galvanic partition between the aluminium of the base unit and the rustproof steel of the screw. This prevents corrosion. The wing, counter lung and back plate are secured on the screws later.

4.2 Handle

The following image shows the handle, which is screwed into the two tubes on the base unit. The handle facilitates easy lifting of the JJ-CCR under all circumstances. The two tubes can be used for an additional trim weight. **Important:** Regardless of whether trim weights are used in the tubes or not, the overall trim of the JJ-CCR will not change! The only difference is the required quantity of lead on the diver's lead belt.

It is possible to use two types of trim weights. One can either opt for lead shot or lead bars. If lead shot is used then it is first necessary to insert a small piece of sponge into the tubes. This prevents the lead shot from falling out. At the same time, the sponge allows the water to run out.

4.3 Stand

The heavy duty stand is secured to the base plate of the base unit with 4 lock screws. The stand prevents the JJ-CCR from falling and can also be used as a fastening point for stages, wheels, buoys, etc. whilst diving.

4.3.1 Attaching the stand to the base unIt

When attaching the stand it is first necessary to insert the base plate into the base unit from above. Before inserting the base plate it is necessary to ensure that the sealing surfaces of the base unit are clean. Carefully check the two base plate O-rings and re-grease these if necessary. When doing so, do not use excessive grease but simply apply a light coating. It must be possible to insert the base plate without applying force and without excessive effort.

During the next step the four lock screws are inserted into the base plate. Afterwards, attach the two blocks. An arrow is marked on the base unit and a notch is visible on the block. These serve to ensure the correct alignment of the stand. The stand is now secured. Important: Do not tighten the four nuts yet because it is first necessary to align the stand correctly. The stand is properly aligned if the arrow on the base unit points precisely to the notch in the block. It is now possible to tighten the self-locking nuts. The following image shows the stand correctly attached.

All parts are shown once again here in overview.

4.4 1st stages and hoses

The next assembly step concerns the 1st stages and hoses (low pressure and high pressure). When developing the JJ-CCR, extensive value was placed on clear and simple hose guidance. A further primary objective was to ensure that the equipment was fitted with the minimum possible number of hoses.

The 1st stage with the M26x2 connection and the green pressure gauge is used for oxygen. A low pressure hose line delivers the oxygen for the solenoid and the second hose is connected with the manual supplemental oxygen valve. A pressure relief valve is included in the first stage. The oxygen pressure relief valve triggers if the medium pressure rises to 10 bar, and thereby prevents the hoses from rupturing if, for example, icing up should occur. The 1st stage with the DIN 5/8" connection and the black pressure gauge is used for diluent. From the 1st stage a hose goes to a small 3-way distributor. Here, the two hoses are connected with the ADV and wing inflator. The diluent pressure relief valve triggers if the medium pressure rises to 15 bar, and thereby prevents the hoses from rupturing if, for example, icing up should occur.

The image to the left shows how the first two stages are connected to the diving tanks. Arrangement of the high pressure and low pressure hoses differs! It is very important to ensure that the hoses are arranged as shown in the image!

The image to the right shows the correct position of the 3-way distributor. This must lie flush with the housing.

4.5 Wing

The next assembly step concerns the wing. The JJ-CCR Rebreather is supplied with one wing, which is optimally tailored to the equipment and has been specially developed for it. The following image shows the correct hose arrangement. The two high pressure hoses must be fed through the lower opening in the wing. All hoses from the diluent must run through the upper opening. In the case of the oxygen, it is only necessary to run the hose for the manual supplemental oxygen valve through the upper opening.

The special position of the pressure gauges is advantageous for a number of reasons. During the pre-dive check they are very easy to read, whilst their position is completely out of the way during the dive. If, during a dive, it is necessary to check the tank pressure (oxygen or diluent) then it is very easy to reach both pressure gauges and to pull these forward.

4.6 Back-mounted counter lungs (BMCL)

Next, the back-mounted counter lungs are attached. The holes permit attachment of the back-mounted counter lungs at various heights.

The fast drain valve must be fed through the loop on the wing.

ATTENTION: Never attempt to lift the equipment using the ADV or T-piece. This can cause serious damage to the counter lungs!

4.7 Back-plate and harness

A washer and wing nut are attached to the back plate. From time to time it is necessary to check whether the wing nut requires tightening, or if it has loosened at all.

The counter lung must be fastened to the harness. The top section of the counter lung is fitted with two fastening straps with Velcro for this purpose. The Velcro must be opened and one strap must be fed between the harness and the shoulder padding. The second strap is then used in order to close the Velcro fastening. The straps with Velcro must not be placed over the shoulder padding!

The following diagram shows the correct fastening of the counter lung to the harness.

The hose with the inflator connection is connected to the inflator from the wing and the complete assembly is then pushed through the inflator retainer on the harness. In this way the inflator always remains in the same position, even during a dive.

4.7.1 Adjust the harness

The harness is supplied fully assembled together with the back plate. However, it is essential that the harness is adjusted to the physical dimensions of the diver. The JJ-CCR Rebreather must always sit as high as possible on the diver's back. It is also necessary to ensure that the equipment sits as tight to the back as possible.

- The JJ-CCR Rebreather is supplied with an adjustable harness. This enables very simple adjustment when putting on, and it is also possible to make underwater re-adjustments if necessary.

- A poorly adjusted harness can have an extremely negative effect on the comfort of the wearer during a dive.

The following images show both correct and incorrect adjustment. The right hand image shows the harness following incorrect adjustment, with the equipment sitting too low on the back. The left hand image shows the harness following correct adjustment, with the equipment sitting in the correct position the diver's back.

CORRECT

INCORRECT

4.8 Connecting the supplemental oxygen valve

Connect the low pressure oxygen hose (inflator connection) with the manual supplemental oxygen valve. It is recommended that both hoses be fed to the manual supplemental oxygen valve through the D-ring (see image). In this way the supplemental oxygen valve always remains in the same position, even during a dive.

4.9 Connecting the ADV

Connect the shortest low pressure hose from the 1st stage (diluent) with the ADV.

Never use any form of tool for this action! It is entirely sufficient for the connection to be hand-tight.

4.10 Soda lime canister (axial)

The JJ-CCR Rebreather is supplied as standard with an axial soda lime canister. A radial soda lime canister is available as an option (see chapter 4.11).

1. Take a water-resistant dust filter and place it in the base of the soda lime canister. Ensure that the base is completely covered and that no gaps are visible at the edge.

2. Fill the soda lime canister until approx. half full with soda lime. Knock lightly all around the outside of the canister, in order to level out the soda lime or compact it.

3. Fill the soda lime canister once more until you can see clearance of 4-5mm. Knock lightly all around the outside of the canister, in order to level out the soda lime or compact it. Now place the second dust filter on top of the soda lime.

IMPORTANT: Soda lime that has already been used must never be used for another dive.

4. Place the spring pressure plate on the dust filter and tighten the nut until it is hand-tight. Then knock lightly all around the outside of the canister, in order to level out the soda lime or compact it. The nut will usually loosen a little during this process and must be hand-tightened again afterwards. ATTENTION: Please do not tighten the nut excessively as this can damage the soda lime canister. The soda lime canister is correctly filled if shaking it does not result in noise being heard from the soda lime.

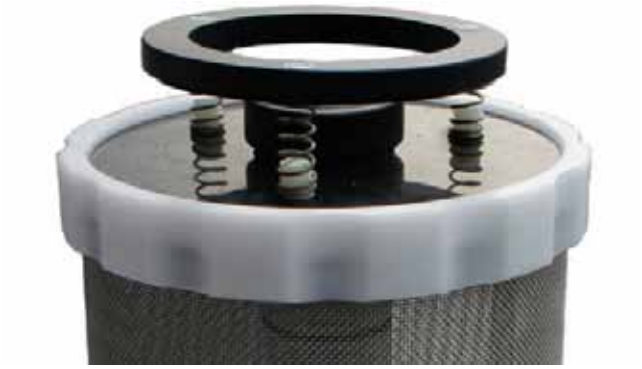
4.11 Soda lime canister (radial)

This section explains the radial soda lime canister available as an option to the JJ-CCR.

- The radial soda lime canister must be filled extremely carefully and it is essential to ensure that the soda lime is correctly compacted.
- In order to fill the radial soda lime canister correctly, take a minimum of 10 minutes for this action.

A water-resistant dust filter is located on the inner tube. This prevents dust from the soda lime from entering the inhalation side of the breathing circuit. In order to replace the dust filter it is possible to simply screw out the entire inner tube. The dust filter is attached by three O-rings.

The radial soda lime canister must be filled in stages. At each stage, approx. 5 – 7 cm of soda lime should be added. Each time soda lime is added this must then be compacted. This is most simply carried out by knocking right around the edge of the black section of the soda lime canister. Fill the soda lime canister until you can see clearance of 4-5mm. Knock lightly all around the black section of the canister, in order to level out the soda lime or compact it.



Never knock on the top section (= grate) of the soda lime canister in order to compact the soda lime. This could damage the soda lime canister.

IMPORTANT: Soda lime that has already been used must never be used for another dive.

Insert the spring pressure plate and tighten the nut until it is hand-tight. Then knock lightly all around the black section of the canister, in order to level out the soda lime or compact it. The nut will usually loosen a little during this process and must be hand tightened again afterwards. The pressure plate must be flush with the soda lime canister. The soda lime canister is correctly filled if shaking it does not result in noise being heard from the soda lime.

4.12 Lid

The lid and the soda lime canister are screwed together with a quarter turn and sealed with an O-ring. This O-ring must be checked carefully prior to assembly! Never tighten the soda lime canister excessively!

Before placing the lid with the soda lime canister into the aluminium housing, the two O-rings must be very carefully checked and re-greased if necessary.
When doing so do not use excessive grease but simply apply a light coating. This is a very important point as it is otherwise possible that the rebreather may leak which may cause serious risk to the user and severe damage to the rebreather.

A leakage in this area will most likely be discovered during the positive and negative pressure test!

Align the lid such that the stud and the hole in the aluminium housing line up with each other.

Push down on the stud and start to push the lid slowly down with the soda lime canister.

The correct position has been attained once the stud pokes out of the hole in the aluminium housing.

4.12 **Lid** (continued)

Push both the HUD and the controller through the handle.

Now connect the oxygen low pressure hose. Only tighten until hand-tight!

Take both breathing hoses and feed these through the handle. Afterwards, your equipment should be in position as in the image above.

Note: The breathing hose in the centre of the lid is for the inhalation side and is always connected to the ADV!

Connect the breathing hoses to the T-piece and ADV. It is not possible to connect these incorrectly because the two connection threads are different. The connection thread on the inhalation side (ADV) is clockwise, whilst the thread on the exhalation side (T-piece) is anti clockwise.

ATTENTION: Never attempt to lift the equipment using the ADV or T-piece. This can cause serious damage to the counter lungs!

4.13 Breathing hose with DSV (Dive Surface Valve)

It is now possible to connect the breathing hose with the DSV (Dive Surface Valve).

Before connecting the breathing hose it is always necessary to check that both check valves are operating correctly!

The arrow on the DSV indicates the flow direction of the breathing circuit. It is not possible to connect the breathing hose incorrectly because the two connection threads are different. The connection thread on the inhalation side (ADV) is clockwise, whilst the thread on the exhalation side (T-piece) is anti clockwise.

Take the HUD and feed it through the two red O-rings on the breathing hose. Then push it into the retainer on the DSV.

The JJ-CCR Rebreather is now fully assembled and the assembly chapter is hereby complete.

For detailed information on the individual main components of the JJ-CCR Rebreather refer to the respective chapters.

WARNING: The equipment is not yet ready for diving! It is always necessary to carry out the pre dive checks in accordance with chapter 8!

5 Main components

This chapter provides descriptions of some of the main components of the JJ-CCR Rebreather and also includes a few essential maintenance and care instructions.

5.1 Lid

The lid with the three oxygen sensors, solenoid, battery compartment, hard-wired controller and HUD is effectively the brain of the JJ-CCR Rebreather. On the right hand side is the connection for the low pressure oxygen hose to the solenoid. The piezo button on the left side is for switching on and off, and for calibrating the HUD (Head Up Display). Under the cap engraved with "JJ-CCR.COM" is the battery compartment. **IMPORTANT:** The lid should always be treated with the utmost care.

5.1.1 Battery compartment

In order to open the battery compartment it is necessary to remove the 10 screws from the battery compartment. The JJ-CCR Rebreather consumes very little power. The batteries usually have a life of between 6-12 months.

A design feature of the JJ-CCR Rebreather is the arrangement of the batteries. As shown in the image, no batteries are integrated into the breathing circuit and the battery compartment is completely sealed. As such battery problems never arise due to increased moisture, which would have been the case within the breathing circuit. Furthermore, the batteries are not exposed to any pressure changes in the battery compartment. Problems with batteries, that may be attributed to severe changes in pressure, are therefore fully excluded with the JJ-CCR Rebreather. Due to the complete sealing of the battery compartment, a fully flooded breathing circuit will also have no effect on the batteries. The two 2 x 6v lithium batteries (CR-P2) are used in parallel for the solenoid. When replacing the batteries please always change both batteries! The current voltage of the batteries can be checked on the status display on the controller. The controller also issues an external battery warning (Low Battery EXT) if the voltage is too low. The 3.6v lithium battery (SAFT 14500) is for the HUD. Please ensure that the battery is inserted correctly into the battery holder. The battery holder is appropriately marked with "+" and "-" signs. It is recommended that the battery for the HUD always be replaced at the same time as both batteries for the solenoid.

5.1.2 Oxygen sensors

The JJ-CCR Rebreather uses three JJ-CCR oxygen sensors. The sensors can be exchanged in seconds without the use of a tool. **IMPORTANT:** Only use sensors of type "R17JJ-CCR"!

The three cells are numbered (1, 2 and 3). These numbers can be found adjacent to the connection on the lid and above each cell.

The wiring of the sensors with the connections in the lid must be carried out correctly according to the numbers because the sequence (1, 2 and 3) corresponds with the display in the controller and the HUD.

5.1.3 Solenoid

The JJ-CCR Rebreather uses a special solenoid, which is characterised in particular by its extremely low power consumption. With this solenoid the defective operating state is always in the closed position – this dramatically reduces the potential for oxygen poisoning in the event of a malfunction.

- Service and/or repair work on the solenoid must be carried out by the manufacturer or by a service centre approved by JJ-CCR ApS!

5.1.4 Breathing hoses

Two breathing hoses are attached to the lid. The breathing hose in the centre is connected to the ADV and the breathing hose on the edge of the lid to the T-piece. In order to remove the two breathing hoses (refer also to chapter 11.2) it is necessary to remove the hex socket head screw with the washer. Afterwards it is possible to remove both hoses.

The two openings have different diameters and it is therefore impossible to incorrectly insert the breathing hoses when assembling.

5.2 Controller

The JJ-CCR Rebreather is supplied with a Shearwater Predator controller, which contains a multigas (nitrox, trimix, heliox) and multimode (OC and CC) decompression computer. The firmware installed on the controller is optimized for the JJ-CCR Rebreather and contains capabilities and functions developed specially for the equipment.

For a detailed description of the controller refer to the chapter 6.

5.3 HUD (Head Up Display)

The JJ-CCR Rebreather is supplied as standard with an HUD (Head Up Display). The HUD functions fully independently of the controller. This means that it has its own electronic and power supply. The HUD monitors all three oxygen sensors and indicates the current PPO2 with three LEDs. Each LED indicates the value for one oxygen sensor. The first LED indicates the value for sensor 1, the second LED indicates the value for sensor 2 and the third LED indicates the value for sensor 3. The sequence of indications also corresponds to the display on the controller. The LEDs are two-coloured LEDs (**green** and **red**). If both colours are activated at the same time then they are **orange**.

The button with which the HUD is switched on is located on the lid. A short push of the piezo button switches on the HUD and a further short push switches it off again. Please ensure that the HUD is switched on before entering the water. If you should forget then your diving partner must switch the HUD on for you retrospectively.

If the LEDs flash **orange** for 30 seconds after switching on then this indicates that the battery charge is too low. In this case the battery for the HUD should be replaced as quickly as possible.

5.3.1 HUD calibration

Calibration of the HUD should take place immediately after calibrating the controller! It is recommended that the HUD and controller always be calibrated at the same time!

1. Open the valve on the oxygen tank
2. Open the mouthpiece (=CC mode)
3. Switch on the HUD
4. Start the calibration sequence for the controller (chapter 6.9)
5. As soon as the controller calibration is complete, the button for the HUD must be pressed three times within one second. This may require some practice but it does prevent unintentional calibration from taking place.
6. If the calibration sequence has started up successfully then all three LEDs will illuminate very brightly in red. If this is not the case then calibration has not commenced!
7. Once all three LEDs are brightly illuminated in red, they must each flash once in orange at short intervals. This indicates a PPO2 of between 0.95 and 1.05. The actual calibration value is 0.98. If the calibration of a sensor fails then the respective LED flashes alternately between green and red.

5.3.2 Reading the HUD

The HUD enables the extremely simple reading of the actual PPO2 for each of the three oxygen sensors. This replaces the requirement for a second dedicated handset for the PPO2 display. The flashing and colour codes for reading the HUD are very simple. Flashing orange indicates a PPO2 of 1.0. In precise terms the PPO2 may lie between 0.95 and 1.05. Each green flash indicates one tenth above 1.0. For example: If an LED flashes in green three times then this indicates a PPO2 of 1.3 for the respective sensor. Every red flash indicates one tenth below 1.0. For example: If an LED flashes in red three times then this indicates a PPO2 of 0.7 for the respective sensor.

LED flashing sequence	Description
	Each LED flashes once in orange, followed by a short pause. This indicates a PPO2 of 1.0 for all three sensors.
	Each LED flashes once in green, followed by a short pause. This indicates a PPO2 of 1.1 for all three sensors.
	Each LED flashes three times in green, followed by a short pause. This indicates a PPO2 of 1.3 for all three sensors.
	Each LED flashes once in red, followed by a short pause. This indicates a PPO2 of 0.9 for all three sensors.
	Each LED flashes three times in red, followed by a short pause. This indicates a PPO2 of 0.7 for all three sensors.

The "pause" between the individual flashing sequences is always precisely the same length (approx. 5 seconds). If the actual PPO2 is more than 0.50 away from 1.00 then the brightness of the LEDS increases. With a PPO2 of 0.20 the LEDs become very bright and flash constantly in red. This is the HUD alarm for a very low PPO2!

5.4 **ADV** (Automatic Diluent Valve)

The JJ-CCR Rebreather is supplied with an ADV. The ADV works in a similar way to a 2nd stage and supplies additional diluent to the breathing circuit if necessary. This is the case for example if considerable negative pressure exists in the breathing circuit. It is also possible to actuate the ADV manually by pressing down on the membrane cap. The ADV does not require any adjustment.

Do not install an inline shutoff valve under any circumstances.

5.5 Manual supplemental oxygen valve

The manual supplemental oxygen valve feeds oxygen into the breathing circuit. The longer the button is depressed, the more oxygen is supplied to the breathing circuit. A light press of the button results in a small quantity of oxygen being fed into the circuit, whilst pushing down heavily on the button adds more oxygen. This facilitates very accurate adherence to the desired PPO2 when the Rebreather is operated in manual mode. It is possible to remove the connection hose and turn the valve through 180 degrees, in order to connect an external gas supply. For example: The oxygen tank is empty and you have a bailout system with oxygen or another gas and now wish to manually feed this into the breathing circuit.

5.6 Manual supplemental diluent valve (optional)

A manual supplemental diluent valve is available as an option for the JJ-CCR Rebreather. This valve enables the manual supply of diluent into the breathing circuit. The longer the button is depressed, the more diluent is supplied to the breathing circuit. A light press of the button results in a small quantity of diluent being fed into the circuit, whilst pushing down heavily on the button adds greater diluent. It is possible to remove the connection hose and turn the valve through 180 degrees, in order to connect an external gas supply.

Note: Without the manual supplemental diluent valve the diluent is fed into the breathing circuit via the ADV (automatically or by means of manual activation).

5.7 **DSV** (Dive Surface Valve)

The JJ-CCR Rebreather is supplied with a DSV. The JJ-CCR DSV is extremely compact and has a neutral weight in the water. Its movement is very smooth and it is possible to switch between open and closed using one hand. A retainer for the HUD is also integrated into the DSV.

ATTENTION: Before connecting the breathing hose with the DSV it is always necessary to check that both shutter valves are functioning correctly. It is also necessary to ensure that the DSV can be opened and closed with ease.

6 Controller

The JJ-CCR Rebreather is supplied with a controller, which contains a multigas (nitrox, trimix, heliox) and multimode (OC and CC) decompression computer. The firmware installed on the controller is optimised for the JJ-CCR Rebreather and contains capabilities and functions developed specially for the equipment.

6.1 Overview

The controller is hard-wired to the JJ-CCR Rebreather lid. The large-scale, high resolution OLED full colour display is visible on the top. Somewhat to the right and behind the small hole in the panel is the brightness sensor. This measures the ambient light and automatically adjusts the brightness of the display to the respective ambient light. One piezo button is situated to the left and one to the right respectively. The complete operation takes place using these two buttons. The piezo buttons used here offer the maximum in flexibility, a long service life and absolute reliability. They cannot catch in the same way as mechanical control buttons and there is no need to clean them in order to maintain their faultless and smooth functionality. The battery compartment is located on the right hand side. This is very easy to open with a coin. The battery (SAFT 14500 – 3.6 volt lithium) can be replaced by the user. One battery has a service life of approx. 100 diving hours and 12 months in standby mode. Also on the right are the water contact sensors. These switch the controller on automatically as soon as it comes into contact with water. On the underside (covered by the arm strap retainer) is the opening for the pressure sensor.

6.2 Functionality

- High resolution OLED full colour display (320 x 160 pixel)
- Air, nitrox, trimix and heliox adjustable as breathing gas
- Bühlmann GF (Gradient Factors) algorithm.
- VPM-B and VPM-B GFS algorithm (optional)
- GF values (low and high) and VPM conservatism adjustable by the user
- GF 99 Bailout and CEIL profile
- Switches on automatically with pressure, depth and water contact
- Closed circuit (CC) and open circuit (OC)
- High altitude diving mode
- Up to 5 different gases for open and closed circuit
- PPO2 real-time display of 3 oxygen sensors including "Voting Logic"
- Display of the mV of the O2 sensors
- Auto-calibration of the oxygen sensors
- Oxygen content for calibration of the oxygen sensors adjustable
- Gas change and gas adjustments possible underwater at any time
- Very simple to change from a closed to an open circuit (OC Bailout)
- Low and high setpoint can be defined (between 0.4 and 1.4)
- Low and high setpoint can be changed underwater at any time
- Automatic or manual change of the setpoints settable
- Use of the metric or imperial system
- Internal logbook
- PC and MAC upload via Bluetooth
- Display showing the speed of ascent
- Display showing the battery voltage
- Display showing the date and time
- Display showing the water temperature
- CNS display
- Warning in the event of low battery voltage (internal and external)
- Alarm display if PO2 too low or high, or with failure to observe a decompression stop
- Automatic brightness adjustment of the display to the ambient light
- Display can be rotated through 180 degrees
- Very simple menu guidance with adaptive menus
- Battery can be replaced by the user (3.6 volt lithium)
- Firmware update can be carried out by the user (via Bluetooth)

6.3 Switching on the controller

In order to switch on the controller press both buttons at the same time. Following the JJ-CCR logo appears for a brief time, following by the controller's main display.

- In order that the controller is able to accept the actual ambient pressure (this is used for the altitude adjustment) it should be switched on briefly whilst at the surface, prior to the dive. If this does not take place and the controller switches itself on automatically (water contact or pressure) then it is unable to determine the current altitude. In this case the controller will assume sea level.

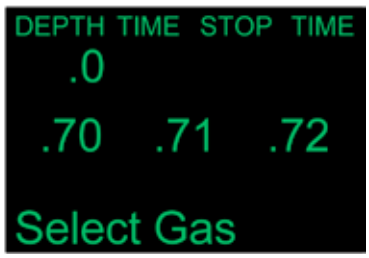
- At the surface the controller switches off again automatically after 30 minutes.

- During the first 2 minutes after diving the controller maintains surface interval and it cannot be switched off at this time.

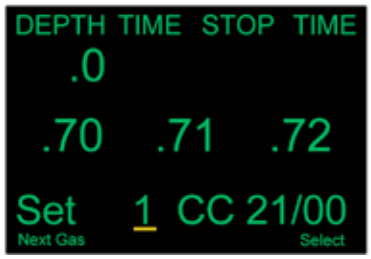
6.4 Left and right buttons

As previously described, complete operation of the controller is implemented via the two piezo buttons. Although both buttons also have special functions, it is possible to summarise the main function as follows:

6.4.1 **Left** (MENU)



The left button (MENU) is used in order to scroll between the various controller menus. Or, if it is necessary to set a value, in order to increase this. In this way, one is able to press briefly on the left button in order to move from the "Switch Setpoint" menu to the "Select Gas" menu.



If one is in the "Select Gas" menu then pressing briefly on the left button will switch to the next gas.

6.4.2 Right (SELECT)

The right button (SELECT) is used in order to confirm the current selection. In some cases this can mean that an actual value is saved or a command is executed.

For example: If the user presses on the right button (SELECT) in the "Switch Setpoint" menu then the setpoint is changed to 1.3.

Or, if the user is in the "Select Gas" menu then pressing on the right button (SELECT) will select the displayed gas.

6.4.3 overview of the button functions

The following table shows the various button functions.

Button	Description
Press both buttons simultaneously	The controller is switched on. **Info:** After 30 minutes, the computer switches off again automatically.
Left (MENU)	If one is in the main display then pressing on the left button (MENU) will switch to the menu. This means that the first menu item is displayed. Pressing briefly switches to the next menu item. In editing mode, the number displayed increases or the next available option is displayed.
Right (SELECT)	Pressing briefly saves a current value or confirms a command. If the controller is not in a menu then pressing the right button results in various display information being displayed (see chapter 6.18). Pressing again switches to the next display. Any error message can be acknowledged or rejected by pressing the right button (refer to chapter 6.19)

6.5 The main display

The controller is equipped with a large display, which presents all of the requisite information for the diver in a clear and comprehensible format.

The display is divided up into 5 sections. There are two sections for the title and headings and three sections for displaying data and information. The topmost position contains the headings for the first line of information. These headings change only when the dive logbook is displayed.

The data or information displayed in this example comprises:

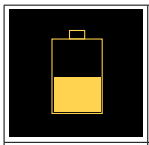
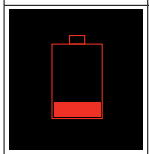
- The current depth of 39.7 metres. If a red flashing "0" is displayed in place of the current depth then the pressure sensor is defective or requires a service.
- An ascending speed of 6 metres per minutes. A maximum of 6 blocks are shown and each block displayed stands for an ascending speed of 3 metres per minute:

	3 metres per minute		12 metres per minute
	6 metres per minute		15 metres per minute
	9 metres per minute		18 metres per minute With more than 18m/min the entire block will flash red.

	15 seconds
	30 seconds
	45 seconds
	60 seconds

The running progress bar beneath "TIME" is a second counter. 60 seconds are shown. Each letter of the word "TIME" corresponds with approx. 15 seconds.

- A battery warning – If the battery is OK then this display will not appear.

	The yellow battery warning appears if the battery voltage falls below 3.28V for 30 seconds. The battery should be replaced as quickly as possible.
	The battery warning flashes red, if the voltage is below 3.15V. If the battery voltage drops to less than 3.2V for 30 seconds then an additional "LOW BATTERY INT" error warning appears in the display. In this case the battery voltage is extremely low and the battery must be replaced immediately!

- Decompression stop at 24 metres for 1 minute

	The next decompression stop is at 24 metres for 1 minute
	If the diver rises above this depth then the two digits flash in red.
	The decompression is cleared and the diver can ascend to the surface

Note: The last decompression stop can be set to either 3 of 6 metres.
The second line shows the current PPO2 measurement values from the oxygen sensors.

1.31 1.29 1.32 1.31 1.29 1.20 1.66 1.67 1.65 .21 .22 .21	The controller constantly displays the current PPO2 measurement values from the three oxygen sensors. A deselected sensor is displayed in **yellow** and is not taken into account in the calculation of the average PPO2. PPO2 values below 0.4 or above 1.6 flash in red.

- The next line is the section for the titles or headings for the bottommost data or information line. Within the various menus, the titles or headings may change frequently in order to display additional information on the data.
- The controller is in the closed mode.

CC	This indicates that the controller is in the closed mode.
OC	This indicates that the controller is in the open mode. This information is displayed in **yellow** because the controller is usually in the closed mode.

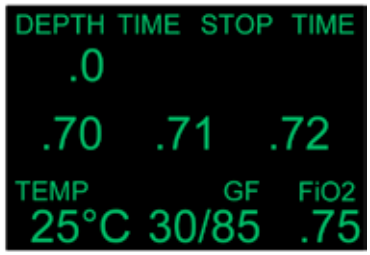
- The current gas is a trimix 15/50 (15 % oxygen, 50 % helium).

O2/HE CC 15/50	The current gas is usually displayed in green.
O2/HE CC 15/50	If another gas is programmed in the respective mode (OC or CC), which should usually be used at the current depth then the active gas will flash in yellow. This indicates that the user should either remove the other gas from the gas list or switch to the better gas.

- The No Decompression Limit (NDL) is 0 minutes because it is already necessary to decompress.

NDL 20	The remaining NDL is 20 minutes.
NDL 5	If the remaining NDL is less than 5 minutes then this is indicated in **yellow**.

- The TTS (Total Time to Surface) is 15 minutes



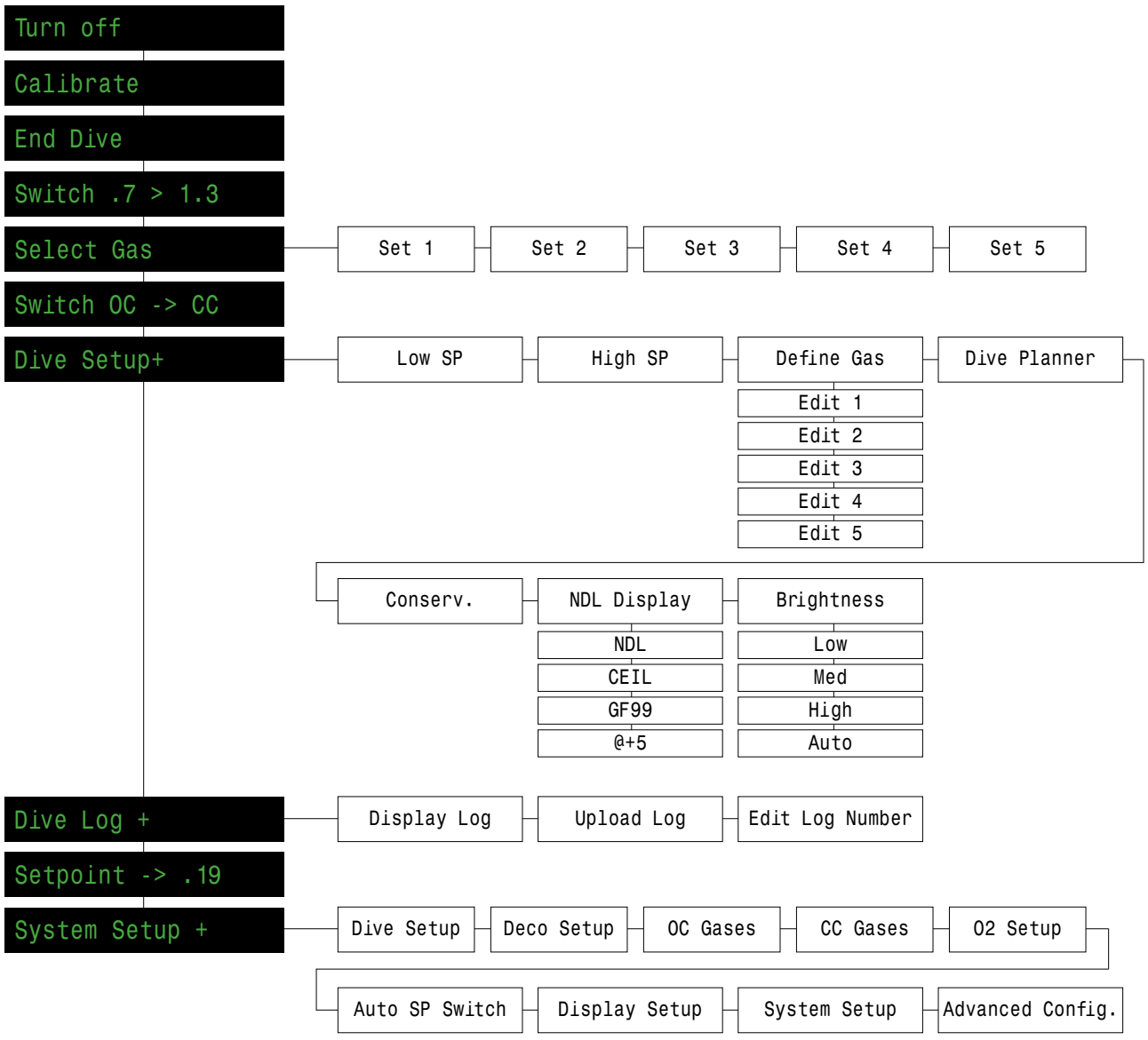
By pressing the right button (SELECT) within the main display, additional status information (status displays) is presented in the footer. A detailed description can be found in chapter 6.18.

6.6 Menu structure

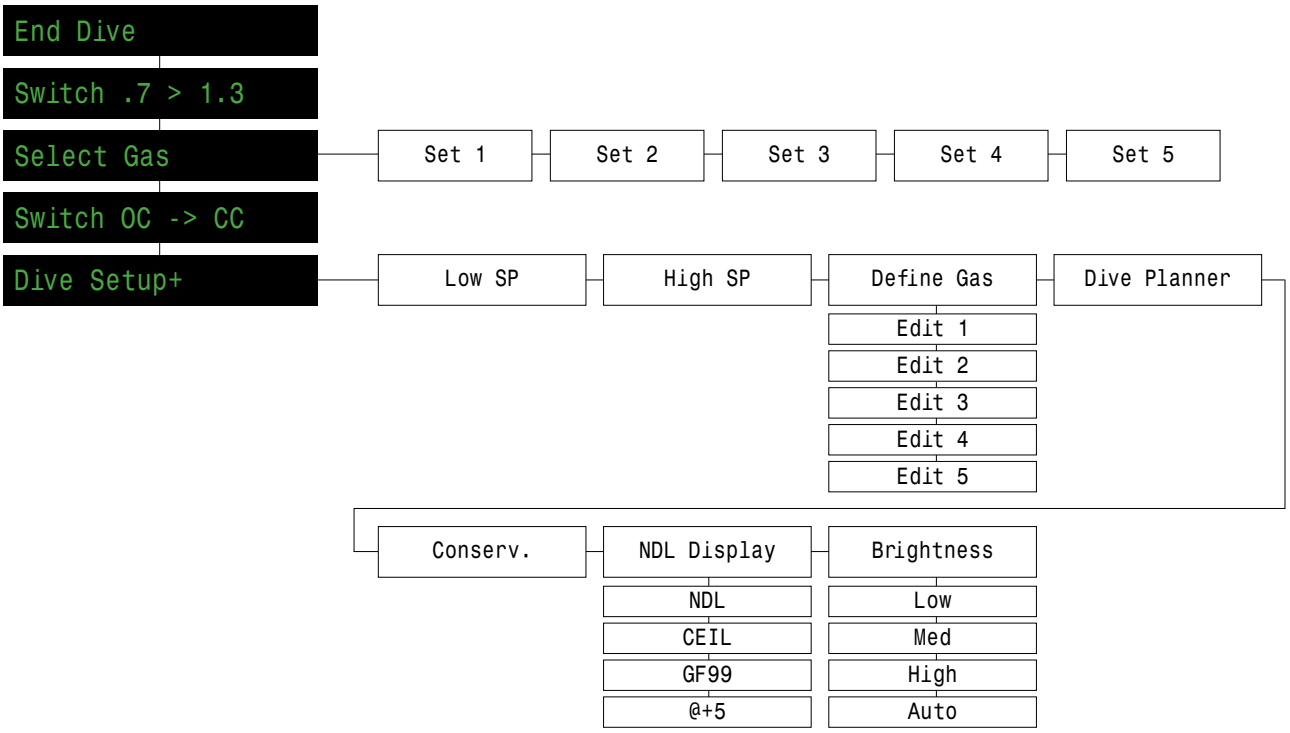
The controller is equipped with adaptive menu guidance. This means that unnecessary menus are automatically hidden in the respective mode. The controller also distinguishes between the display of the menu item in diving mode or above water. As such, the two menu items "Turn Off" and "Calibrate" are unavailable when in diving mode.

When the user is in a menu, the controller continues to function in the background. This means for example that the values of the oxygen sensors are read out on a permanent basis, and the controller maintains the selected setpoint. Likewise, calculation of the decompression takes place constantly. If the user is in a menu and does not press either of the two buttons for an extended period then the controller will exit this menu and return to the main display. Settings that have been changed during this period are saved. Everything that has not been definitively confirmed upon returning to the main display is rejected and the original values are retained.

The following diagram shows the complete controller menu structure:



In diving mode the menu structure is further reduced because only those menu items are displayed, which can be adjusted during the dive. Alongside "Turn Off" and "Calibrate", the complete "System Setup" incl. all submenus is also hidden when in dive mode. The following diagram shows the complete menu structure when in dive mode:



6.7 Menu reference

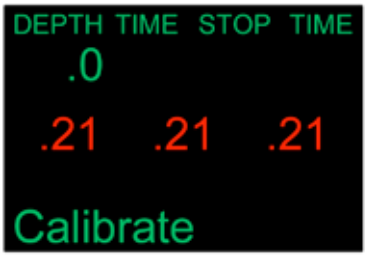
In this chapter all controller menu items are listed individually and explained.

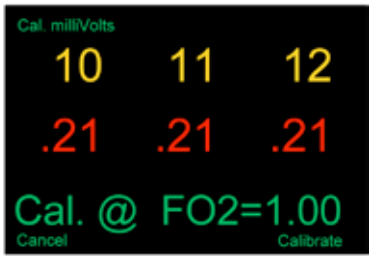
6.8 Turn Off

The controller is switched off using this menu item. Switched off is really the wrong term because the controller is essentially put into standby mode, in which it uses very little power. In the background the tissue saturation is still being calculated for example (catchword: Repetitive dives). Likewise, the time and date are naturally also updated. In order to switch on the controller the user must press both buttons at the same time. As soon as the background lighting switches on the user can release the buttons.

- In dive mode this menu item is **NOT** displayed!
- During the first 2 minutes after diving, the controller maintains surface interval and it cannot be switched off at this time.

6.9 **Calibrate** (calibration of the O2 sensors)





The O2 sensors are calibrated with oxygen via this menu item. The controller for the JJ-CCR Rebreather has a calibration sequence that runs automatically.

- In order to calibrate and dive at altitude it is necessary to set the "Altitude" option to "Auto" in the "Display setup" menu. Only then is the current ambient pressure taken into account in the calibration.
- PPO2 values below 0.4 flash in red. If the sensor millivolts are outside an acceptable range then they are shown in **yellow**. Acceptable at 1013 mBar and 98% O2 is a range of 30mV to 70mV.
- Important: The calibration gas must be set to 100% oxygen (see system setup – option "Calibrate O2")
- In countries in which 100% oxygen is not available it is naturally necessary to use the respective oxygen content.
- The controller does not stipulate the individual steps during calibration! It is therefore very important to precisely adhere to the sequence.

1. Open the oxygen valve and check the current pressure in the oxygen tank.
2. Open the mouthpiece (=CC mode)
3. Select the menu item "Calibrate". Check that the calibration gas displayed is 100% oxygen (=CAL @ FO2 = 100).
4. Pressing the right button (YES) results in the calibration process starting.
5. The solenoid now allows oxygen to flow into the circuit until the sensor millivolts stabilise and no longer change. This may take some time. Please be patient. During calibration, the PPO2 and MV for every O2 sensor is displayed.
6. Calibration has been successfully completed as soon as the controller once again switches to the main display.

If the O2 sensors are not calibrated or the millivolts lie outside the permissible range (35-60 mV), "**FAIL**" will appear in place of the PPO2 display. This takes place automatically after every software upgrade because the calibration values are overwritten during an upgrade.

Calibration also takes account of the current height above sea level. If, for example, the ambient pressure is 885 mBar with .87 ATA and the calibration gas is 98% oxygen then a PPO2 of 0.85 will be displayed following calibration!

It is possible that "**FAIL**" may be displayed against all three sensors.

This is the case if the calibration gas in the "O2 Setup" menu has changed. If the PPO2 of the calibration gas changes then the current calibration immediately becomes invalid and "FAIL" is displayed against all three sensors. The same display is also possible if the calibration is erroneously carried out in air. The PPO2 values are only displayed once again after successful calibration.

- In dive mode the menu item "Calibrate" is NOT displayed!
- The oxygen sensors should be calibrated regularly. This should ideally take place prior to every dive and at least once daily with multiple dives.

6.9.1 PPO2 monitoring

When calculating decompression, the average PPO2 value is used after selection of all three sensors. This process is commonly known as "Voting Logic". The actual value used is displayed with the status information (AvgPO2). This is the case as long as no sensor has been switched off, i.e. deselected. A deselected sensor is displayed in **yellow** and starts to flash. In this case, the average PPO2 of the two remaining sensors is used for calculating the decompression. PPO2 values below 0.4 or above 1.6 flash in **red**. If the controller is switched to OC it uses the PPO2 of the active gas at the momentary depth in order to calculate the decompression.

6.9.2 Checking calibration during a dive

It is a wise precautionary measure to check the correct functionality of the oxygen sensors from time to time during a dive. It is first necessary to flush the diluent from the circuit (= diluent flush). Then press the right button once in order to display the PPO2 of the diluent at the current depth. If the circuit has been correctly and fully flushed with the diluent then the oxygen sensors must display the same PPO2 value. If this is not the case then the diver should switch immediately to an OC Bailout .

Another test through which to ascertain whether the oxygen sensors are functioning correctly is to flush the circuit at 6 metres with oxygen (= oxygen flush). The PPO2 should lie above 1.5 after this. If this is not the case, the oxygen sensors should be replaced.

6.10 End Dive

Within the "Advanced Config" menu you can specify for how long the controller will stay in the dive mode after surfacing. Another descend during this time will count as one dive in the internal dive log. With the option "End Dive" the diver can end the current dive and another descend will be added as a second dive in the internal logbook.

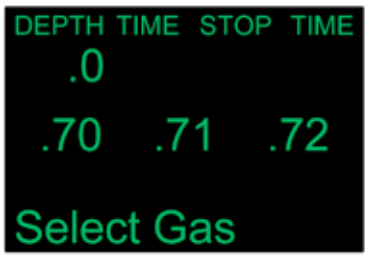
- The option "End Dive" is only available when the controller is still in dive mode and when the diver is on the surface.

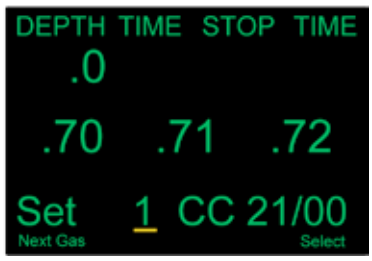
6.11 Switch Setpoint

Using this menu item it is possible to change the controller setpoint. In the "Dive Setup +" menu (refer to chapters 6.14.1 and 6.14.2) it is possible to define the two setpoints (low and high). In the example, a low setpoint of .7 and a high setpoint of 1.3 are defined.

- In dive mode, when you are not at the surface, this is the first menu item because "Turn Off" and "Calibrate" are both automatically hidden in dive mode.

6.12 Select Gas





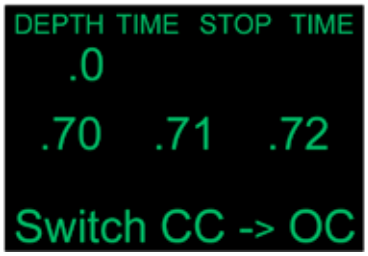
Using the menu item it is possible to select one of the predefined gases. The selected gas is used as a diluent in closed mode (CC) and as a breathing gas in open mode (OC).

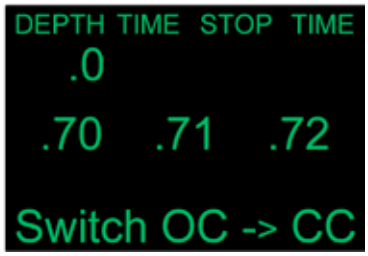
- The selectable gases are sorted from highest to lowest oxygen content! If two gases have the same oxygen content then the gas with the lower helium content is brought to the front of the sequence.
- With a gas change the diver receives no gas recommendation. The diver must personally select the desired gas from the list of available gases.
- If an alternative gas to the set gas is available then the active gas starts to flash orange in the main menu. The display thereby indicates switching to the other gas or removing it from the list of gases if it is not to be used.

If "Select Gas" is displayed then it is necessary to press the right "Select" button, in order that the first available gas is displayed. Pressing the left "Next Gas" button multiple times results in all available gases being displayed, one after the other. Once all available gases have been displayed the "Select Gas" menu appears once again without the current selection having actually changed. The current active gas is displayed with an "A" before the number.

Once the desired gas is displayed it can be selected by pressing the right button (Select). The controller switches automatically to the main display and the current gas is now shown in the footer. The JJ-CCR controller enables the definition of 5 different gases in OC mode and CC mode respectively. The gases can be entirely different and only those gases applicable to the actual active mode are displayed. This means that only the maximum 5 gases for OC mode are displayed when in OC mode, and likewise only the maximum 5 gases for CC mode are displayed when in CC mode. The separation of the two gas lists enables a simple OC Bailout: The diver dives with the JJ-CCR Rebreather and has various stages throughout, at which he can switch to this in the event of a rebreather failure. In CC mode he defines his diluent and in OC mode he defines all gases that he has as additional stages. If, during the dive, there is a problem with the rebreather and the diver is required to switch to stages, he simply switches the controller from CC mode to OC mode. Because all gases are already defined, the decompression and TTS are appropriately adjusted and he is able to continue diving safely without needing to make any further setting adjustments on the controller.

6.13 Switch OC/CC (between open/closed circuit)



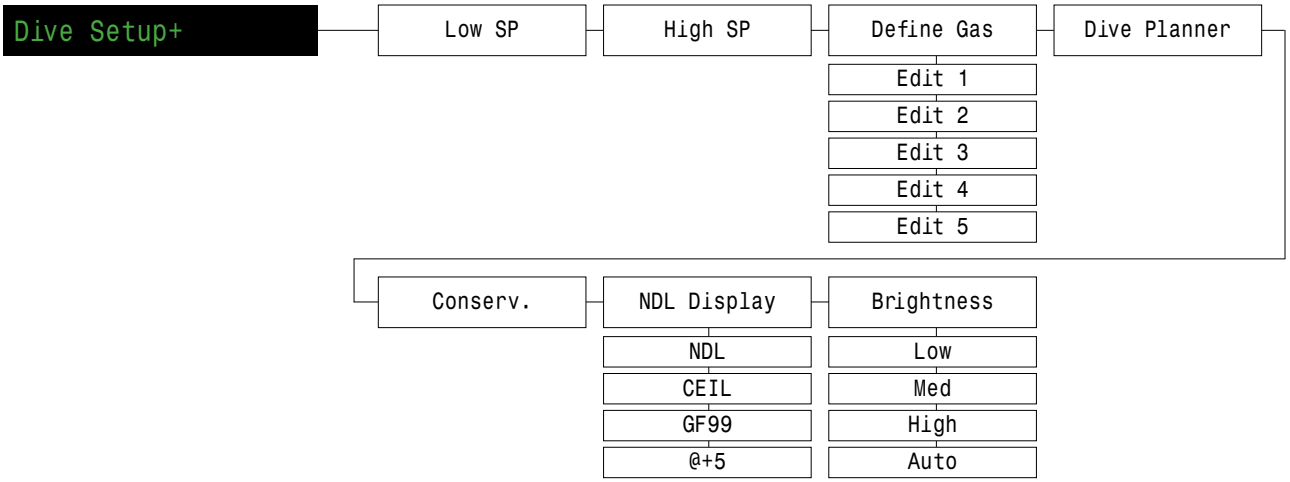


Using this menu item it is possible to switch from the closed mode (CC) to the open mode (OC). The active mode is displayed first and the arrow indicates the mode into which it is possible to switch. In the first figure the controller is in CC mode and is being switched to OC mode. In the second figure the controller is in OC mode and is being switched to CC mode. In order to switch it is necessary to press the right button (Select). After this is controller switches automatically to the main display. The footer (CC or OC) indicates which mode the controller is currently operating in.

- The display for the open mode (OC) is shown in orange because the controller should usually be in CC mode.
- If the diver switches to open mode then the gas best suited at that time to being used as a breathing gas is selected and applied for the decompression calculations. The diver is subsequently able to change to an alternative gas at any time, if he does not concur with the selection. To do so he must choose the "Select Gas" menu function.

6.14 Dive Setup+

Using this menu item the diver can access various submenus:



Pressing the right button (Select) once takes the diver to the first submenu. Pressing the left (Menu) button multiple times results in all available submenus being displayed, one after the other. Once all available submenus have been displayed, the "Dive Setup+" menu appears once again

6.14.1 **Low SP** (low setpoint)

Using this menu item it is possible to set the low setpoint. The low setpoint that is currently set is always displaed. In the figure a low setpoint of .7 (= 0.7) is set.

- Permissible setpoint values are 0.4 to 1.5.

By pressing the right button "Edit" it is possible to set the low setpoint. "Edit Low SP" appears in the footer and the low setpoint is displayed as .4. Pressing the left button "Change" results in the low setpoint being increased in steps of 0.1. This means that the button must be pressed multiple times, until the desired low setpoint is displayed. Once the desired low setpoint is displayed it can be stored by pressing the right "Save" button.

Following this, "Low SP" is once again displayed with the current defined value in the footer.

By pressing once on the left button "Next" the diver is now able to display the next submenu.

6.14.2 High SP (high setpoint)

Using this menu item it is possible to set the high setpoint. The high setpoint that is currently set is always displayed. In the figure a high setpoint of 1.3 is set.

- Permissible setpoint values are 0.4 to 1.5.

By pressing the right button "Edit" it is possible to set the high setpoint. "Edit High SP" appears in the footer and the high setpoint is displayed as .4. Pressing the left button "Change" results in the high setpoint being increased in steps of 0.1. This means that the button must be pressed multiple times, until the desired high setpoint is displayed. Once the desired high setpoint is displayed it can be stored by pressing the right "Save" button. Following this, "High SP" is once again displayed with the current defined value in the footer.

Following this, "High SP" is once again displayed with the current defined value in the footer.

By pressing once on the left button "Next" the diver is now able to display the next submenu.

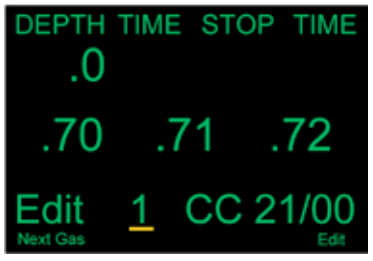
6.14.3 Define Gas

Using this menu item it is possible to set the breathing gases used. The controller allows the diver to set 5 different gases in OC mode (open circuit) and 5 different gases in CC mode (closed circuit).

In order to set the breathing gases for the open circuit the controller must be in OC mode, and likewise when setting the gases for the closed circuit it must be in CC mode.

It is possible to define the percentage oxygen and helium content in each gas.

- The "A" in front of the gas number indicates the active gas. This cannot be deleted, i.e. setting 0% O2 and 0% helium generates an error message. However, the gas can be adjusted at any time.
- The gases set are used for the projection of the total Time To Surface (TTS). It is therefore essential to define only those gases that are actually available.
- Decompression of the current active gas is correctly calculated.
- All gases with 0% oxygen and 0% helium are automatically hidden in the "Select Gas" menu.
- The gases can also be adjusted underwater.



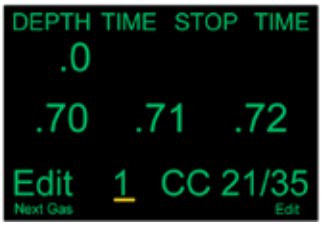
Pressing the right button "Define" switches to the display for the first gas settings.

Pressing the left button "Next Gas" results in the next gas being displayed. The gases are numbered from 1 – 5. The sequence in which the gases are input is irrelevant. In the "Select Gas" menu all available gases are always displayed in order according to their O2 content (from the highest to the lowest). If two gases have the same O2 content then the gas with the lower helium content is brought to the front of the sequence.

By pressing the right button "Edit" it is possible to edit the gas. The O2 content of the gas is set first. Only one digit of the number is changed at a time. The ten's are always set first. Pressing the left button "Change" results in the displayed digit being increased by 1. After the digit has reached 9 it will revert back to 0 again. Pressing the right button (Next) once takes the diver to the units digit.

Next, the helium content of the gas is set. Only one digit of the number is changed at a time. The ten's are always set first. Pressing the left button "Change" results in the displayed digit being increased by 1. After the digit has reached 9 it will revert back to 0 again. Pressing the right button (Next) once takes the diver to the units digit.

Upon arriving at the units digit for the helium content it is possible to save the gas data by pressing the right button "Save".



Pressing the left button "Next Gas" switches to the next gas. If the gas number is preceded by an "A" then this is the current active gas. It is possible to adjust this but not to delete it (0% O2 and 0% HE).

If all 5 gases have been displayed then the user automatically arrives back at the menu item "Define Gas".

6.14.4 Dive Planner

The dive planner facilitates the calculation of decompression profiles for simple dives. Two different modes are available here:

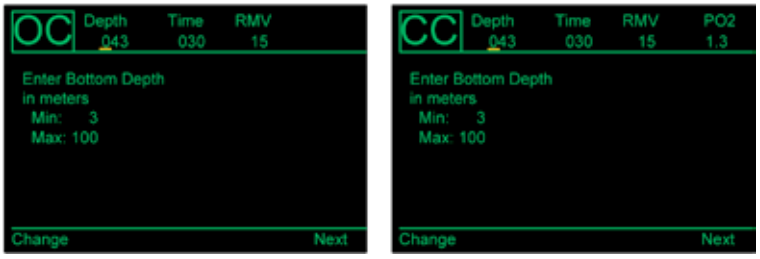
Mode	Description
Surface mode	In the surface mode the user is able to plan a dive on the basis of the parameters entered. The current CNS load is taken into account during the calculation.
Dive mode	In dive mode the decompression profile is calculated based on the current situation.

When calculating the decompression profile all gases input and the defined low and high gradient factors are taken into account. Additionally, the profile for the respective active circuit (CC or OC) is generated. The dive planner is only intended for planning simple dives. Multi-level dives are therefore not supported. Furthermore, the following assumptions are applied to the calculation:

When calculating the decompression profile all gases input and the defined low and high gradient factors are taken into account. Additionally, the profile for the respective active circuit (CC or OC) is generated. The dive planner is only intended for planning simple dives. Multi-level dives are therefore not supported. Furthermore, the following assumptions are applied to the calculation:

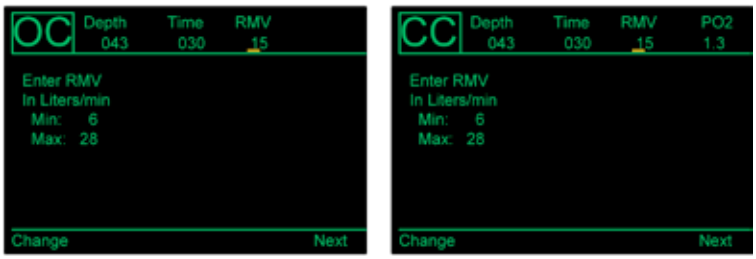
- The speed of descent and ascent is 10m per minute.
- In OC mode the gas with the highest PPO2 below 1.61 is used for a gas change.
- In CC mode the gas with the highest PPO2 below 1.05 is used for a gas change (diluent).
- The last decompression stop is at 3 metres.
- In CC mode the same PPO2 is applied to the entire dive.
- The Respiratory Minute Volume (RMV) is identical during the dive and decompression.
- The dive planner does not undertake any profile validation. This means it does not check whether the CNS load is too high, whether nitrogen narcosis may occur, if the gas consumption is correct or whether isobar counter diffusion may arise. ©

The following figures show the dive planner in surface mode.

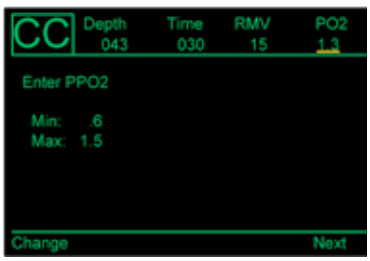


The first figure shows the dive planner in OC mode and the second shows it in CC mode. In CC mode it is additionally possible to define the PO2. First set the depth. Only one digit of the number is changed at a time. The hundred's are always changed first. Pressing the left button "Change" results in the displayed digit being increased by 1. After the digit has reached 9 it will revert back to 0 again. Pressing the right button (Next) results in a jump to the next digit. The respective maximum and minimum values are shown in the display.

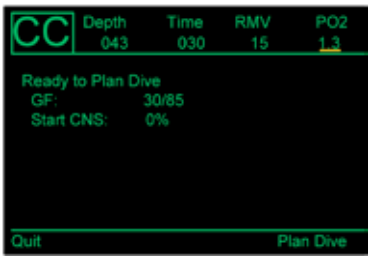
The desired bottom time in minutes is set in the same manner.



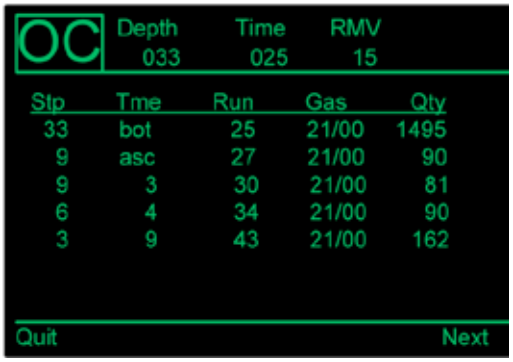
Following this, the respiratory minute volume (RMV) is set in litres.



In CC mode it is additionally possible to define the PPO2.



Once all parameters have been defined, the dive planner displays the set gradient factors and the current CNS loading. It is also possible to use the dive planner for the calculation of repetitive dives because the current CNS loading can be taken into account. By pressing the left button "Quit" the user exits the dive planner, whilst pressing the right button "Plan Dive" results in the calculation starting.



Display	Description
Stp	Indicates the depth of the stop in metres
Tme	Indicates the time of the stop in minutes
Run	Indicates the dive run-time in minutes
Gas	Indicates the breathable gas. The dive planner takes into account all gases entered!
Qty	Indicates the gas volume in litres. This info is now displayed in the OC or BO plan. The CC plan does not display this information!
Bot	Bottom time
Asc	Ascent time

If there is insufficient space for the complete plan on one display screen, the user accesses the next screen by pressing the right button "Next". Once the complete decompression plan has been displayed, pressing the right button "Next" generates a summary of the gas consumption in the display (only in the OC or BO plan!). The dive planner calculates the gas consumption of all gases entered!

The final display presents a summary.

Display	Description
Run	Total dive run-time in minutess
Deco	Total decompression time in minutes
CNS	Total CNS loading as a percentage

In CC mode it is possible to press the right button "Plan BO" when viewing the summary in order to start the calculation of a Bailout plan. The Bailout plan is generated in OC mode and takes into account all OC gases entered. The Bailout plan is generated for the end of the bottom time entered. If, for example, the bottom time is set at 25 minutes at a certain depth, the Bailout plan calculates the decompression profile in OC mode after 25 minutes has passed. Because the dive planner is located in the dive menu, it is also possible to use it underwater, i.e. in dive mode. It is not possible to adjust any settings in dive mode; instead the decompression profile is always calculated on the basis of the current situation. If required it is possible to have a detailed decompression plan displayed in place of information pertaining to TTS, decompression stop and time on the main display. As previously described, this contains all decompression stops including time, gas change and - in OC mode - even the gas consumption. In CC mode the gas consumption is not included in the list. It is therefore not possible to display an OC Bailout plan. The OC Bailout plan also assumes the current situation in dive mode. As such it is possible to check the decompression profile format at any time, if one is required to switch immediately to OC.

6.14.5 Conserv. (Conservatism)

Using this menu item it is possible to set the conservatism for the calculation of the decompression based on gradient factors (low and high). Two different modes are available here:

Mode	Description
Surface mode	In surface mode the user is able to set both gradient factors (low and high).
Dive mode	In dive mode the user is only able to set the high gradients.

- These settings can have a massive effect on the decompression calculations of the controller!
- If the diver does not know what effects these settings will have, no setting adjustments should be made for safety reasons!
- In order to understand the settings the diver must be aware of the theory of the gradient factors, M-values, inert gas pressure, etc!

A range of articles on this subject can be found on the internet. The article by Eric C. Baker can be recommended in particular.

If the settings are to be changed (edit mode) then it is necessary to push the right button "Edit".

First the low gradient factor is set (visible at the "GF Lo" display). Only one digit of the number is changed at a time. The ten's are always set first. Pressing the left button "Change" results in the displayed digit being increased by 1. After the digit has reached 9 it will revert back to 0 again. Pressing the right button "Next" once takes the diver to the units digit.

Now the high gradient factor is set (visible at the "GF Hi" display). Only one digit of the number is changed at a time. The ten's are always set first. Pressing the left button "Change" results in the displayed digit being increased by 1. After the digit has reached 9 it will revert back to 0 again. Pressing the right button "Next" once takes the diver to the units digit.

Pressing the right button "Save" saves the current settings. Editing mode is closed and the user switches to the next menu item.

6.14.6 NDL Display (GF99, CEIL, NDL or @+5 display)

Using this menu item it is possible to set three different displays (NDL, CEIL, GF99 and @+5) for the decompression. It is also possible to change these displays during the dive.

By pressing the right button "Edit" the user accesses the edit mode (second screen). Pressing the left button "Change" multiple times result in the individual modes being selected. Once the correct mode has been located, this is selected by pressing the right button "Save", after which the edit mode is exited.

Option	Description
NDL	NDL (No Decompression Limit): This display is as previously described. The controller indicates the no decompression limit throughout the entire dive. If the remaining NDL is less than 5 minutes then this is indicated in **yellow**.

CEIL	When implementing this setting, the no decompression limit (=NDL) is first displayed on the controller. As soon as this is "0" the display switches from NDL to CEIL. This display enables constant decompression (also known as "Diver on the rope"). The controller manufacturer states the following in this regard: "There is limited information on the effects of a constant ascent in place of the classic model of adhering to individual decompression stops and only resuming the ascent once these are complete. According to the manufacturer's information all decompression stops should be adhered to. It appears intuitive to stop and give the bubbles the opportunity to be reabsorbed. During a constant ascent the ambient pressure is consistently reduced and this prevents the bubbles from diminishing. The computer therefore indicates a "Missed Deco" alarm message during and after a dive. The display of the next decompression stop flashes during the dive if the diver is higher than the deco stop., However, the higher gradient is taken into account and the calculated outgasing is faster than stopping at the decompression stops."
@+5	The setting "@+5" indicates the new TTS if the diver were to stop for 5 further minutes at the current depth.
GF99	When implementing this setting, the no decompression limit (=NDL) is first displayed on the controller. As soon as this is "0" the display switches from NDL to GF99. The current supersaturation gradient is then displayed as a percentage for a pure Bühlmann (99/99) profile. The number is calculated with reference to the current ambient pressure and M-value. It would appear conceivable that the figure is the current gradient factor, although this is not the case because this is calculated otherwise. The current GF generates a stop rounded to the nearest 3 metres. A GF of 40 reflects a stop at the next 4.5 metres. The computer rounds the value up and displays a stop in the next 6 metres. The GF form a line from the start of decompression, started at the deepest stop and going right to the surface. The gradient used for the stops is based on this line. When ascending per Bühlmann the decompression depth is reached if the ambient pressure of the next highest deco stage does not undercut the maximum ambient pressure tolerated by all relevant tissues. The GF99 value displayed can be used for various purposes. For example, in order to carry out an aggressive ascent, which still runs constantly per a "reasonable" format. If a diver loses a large proportion of his breathing gas and is required to ascend rapidly then he is able to ascend until a GF99 value of "90" is displayed. If, in doing so, an intended deco stop is missed out then a "Missed Deco" warning is displayed and must be confirmed. It is then necessary to wait until this reduces to "80" and then ascend once again until "90" is displayed once more. This results in a Bühlmann decompression profile with very low conservatism. However, in an emergency this may constitute an acceptable risk. [redacted] Another possible use of the display is when carrying out a slow ascent, in order to be able to continue observing the underwater world in peace, whilst also remaining within the decompression phase by adhering to the GF99 value above "0". At the last 3 metres a massive increase in the gradient is seen. The information in the GF99 display can also be used in order to ascend as slowly as possible from the last 3 metes to the surface. This may be very helpful with very long and/or very deep dives in particular.

The controller manufacturer has issued the following remarks:
"All of this is based on the theory of gradient factors, which may in certain circumstances, be entirely incorrect. Significant differences of opinion exist in the research community regarding the nature and application of decompression. All of the techniques described here should be viewed as experimental. However, the applied concepts may be helpful to the advanced diver."

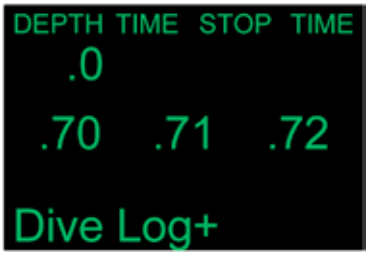
6.14.7 Brightness

Using this menu item it is possible to set the brightness of the display. Pressing the right button "Edit" switches the mode. Four different modes are available for selection:

Mode	Description
Auto	The brightness sensor measures the ambient light and automatically adjusts the brightness of the display.
Low	Permanent minimum brightness
Med	Permanent medium brightness
High	Permanent maximum brightness

- The higher the brightness, the higher the battery consumption! It is therefore recommended that the "Auto" mode be used.

6.15 Dive Log+

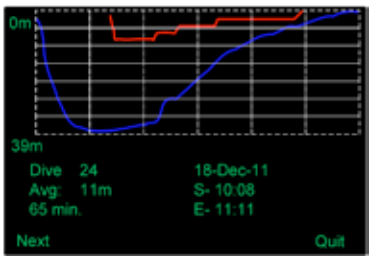


Using this menu item it is possible to access a range of submenus for the controller's dive logbook.

Pressing the right button (Select) once takes the diver to the first submenu. Pressing the left (Menu) button multiple times results in all available submenus being displayed, one after the other. Once all available submenus have been displayed, the "Dive Log+" menu appears once again.

6.15.1 Display Log

Via this menu item it is possible to display the controller's dive logbook. Pressing the right button "Display" results in the last - or the current - dive being displayed.

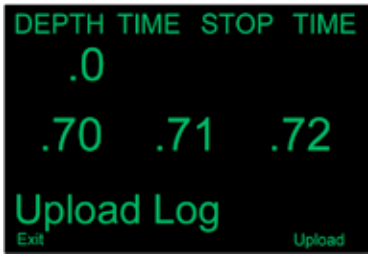


The dive profile is presented in blue and the decompression profile is shown in red.
The following additional information is also shown:

- Maximum depth
- Dive number
- Average depth
- Duration of the dive in minutes
- Date of the dive
- Starting and ending time of the dive

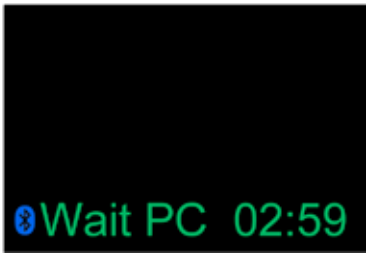
Each time the left button "Next" is pressed, an earlier dive is displayed. This is repeated until all dives have been displayed. Once all dives have been displayed "END OF DIVES" appears and pressing the right button "Quit" results in the user returning once again to the "Display Log" menu. The controller stores the profile of approx. 20 diving hours.

6.15.2 Upload Log



Via this menu item it is possible to transfer the controller's complete dive logbook via a Bluetooth interface to a PC. The latest version of the Shearwater Desktop Software must be installed on the PC. This software is available as a free download on the manufacturer's homepage.

Pressing the right button "Upload" results in the controller being switched to ready mode, in order to facilitate the data transfer.



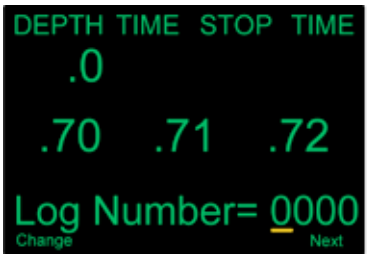
As soon as the Shearwater Desktop Software starts the transfer from the logbook, the display changes from "Wait PC" to "Sending". The transfer from the logbook to the PC may take a few minutes.

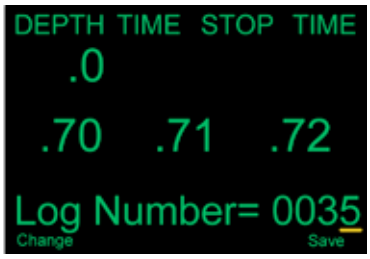
The data transfer must take place within three minutes. After three minutes the Bluetooth interface in the controller is switched off again in order to save power.

6.15.3 Edit Log Number

Using this menu item it is possible to adjust the internal dive number. This is helpful, for example, if the logbook has been deleted and the sequential dive numbering is to be continued where it left off. Or if the user wishes the dive numbers in the logbook to be identical to the number of actual dives.

By pressing the right button "Edit" it is possible to adjust the dive number.





The next dive receives the number defined here +1. I.e. the entry 0035 will result in the next dive being issued with the number 36.

6.16 Setpoint -> .19

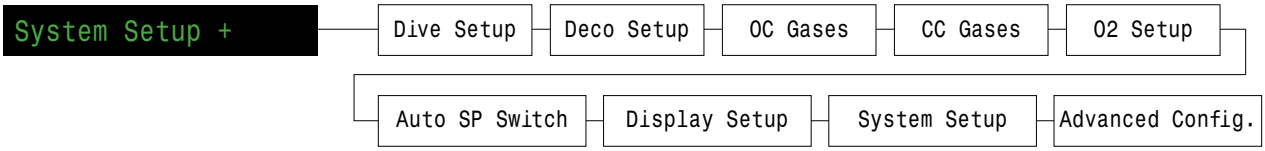
This menu item is only displayed in surface mode. It enables a switching off of the solenoid whilst the circuit is in air. This prevents the solenoid from being permanently active. The function is mainly used during a firmware upgrade or when uploading dives to the PC.

Switching to the normal setpoint takes place in the "Switch SP" menu. The controller switches automatically to the low setpoint if a dive is to be started with the setting .19.

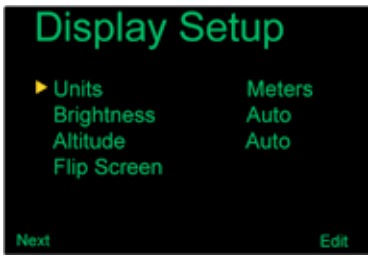
6.17 System Setup+

Using this menu item it is possible to access a range of submenus for the basic configuration of the controller. This menu item, as well as all of the submenus contained within it, are unavailable in dive mode. As such, basic configuration of the controller can only be carried out at the surface.

Various options such as "Low and High Setpoint" or "NDL Display" can also be found in the dive menu and can therefore be retrospectively adjusted as necessary when underwater.

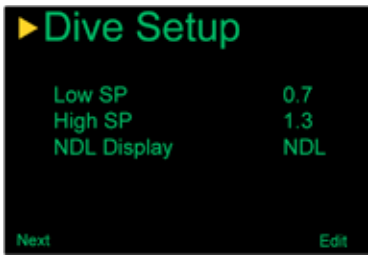


The system setup submenus are grouped into various areas. All of the settings relevant to one area can be viewed on a single screen.



All settings (basic settings, gases used, etc) can therefore be implemented quickly and easily prior to the dive. If necessary, it is also possible to make adjustments underwater via the dive setup menu, as previously described. It is essentially irrelevant whether settings are adjusted in the dive menu or within the system setup submenu! It is always the same values that are changed. If, for example, the diver sets the low SP in the dive setup to 0.8 then this value will also be displayedunder low SP in the dive menu. If the diver changes this value back to 0.7 in the dive menu then this value will also be adjusted in the dive setup.

6.17.1 Dive Setup (overview)

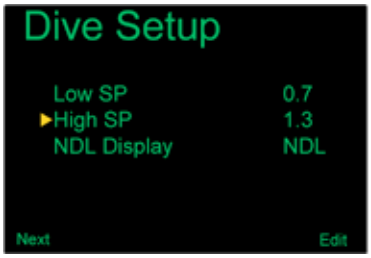


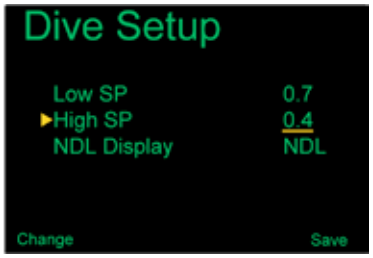
The first submenu of the system setup is "Dive Setup". The first three options are identical to those in the dive setup menu.

6.17.2 Low Setpoint (Dive Setup)

By pressing the right button "Edit" the user accesses the edit mode for the low setpoint. In order to change the value it is necessary to press the left button "Change" until the desired value is displayed (possible values are 0.4 to 1.5). By pressing the right button "Save" the current value is saved and the user switches to the next entry. The current entry is marked with a "▶".

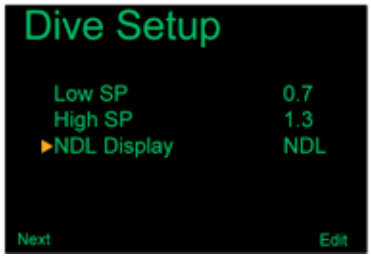
6.17.3 High Setpoint (Dive Setup)

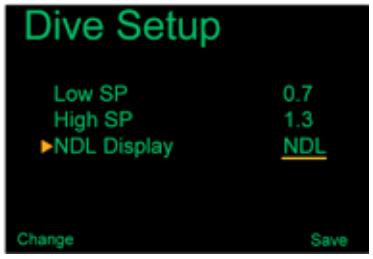




By pressing the right button "Edit" the user accesses the edit mode for the high setpoint. In order to change the value it is necessary to press the left button "Change" until the desired value is displayed (possible values are 0.4 to 1.5). By pressing the right button "Save" the current value is saved and the user switches to the next entry. The current entry is marked with a "▶".

6.17.4 NDL Display (Dive Setup)





The NDL display options are identical to those in the dive setup menu:

- NDL
- CEIL
- GF 99
- @+5

(See chapter: 6.14.6 for a more precise explanation of the options).

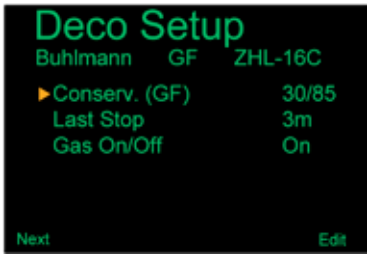
By pressing the right button "Edit" the user accesses the edit mode for the NDL display. In order to change the settings it is necessary to press the left button "Change" until the desired option is displayed. By pressing the right button "Save" the current setting issaved and the user switches to the next entry. The current entry is marked with a "▶".

6.17.5 Deco Setup (overview)

The second submenu of the system setup is "Deco Setup". Here, it is possible to define various parameters for the decompression calculation.

- Within this menu you can also select the decompression algorithm, taking into account that the optional VPM-B / VPM-B/GFS algorithm is enabled.

6.17.6 **Conserv.** (Deco Setup)



Using this menu item it is possible to set the conservatism for the calculation of the decompression based on gradient factors (low and high).

- These settings can have a massive effect on the decompression calculations of the controller!
- If the diver does not know what effects these settings will have, no setting adjustments should be made for safety reasons!
- In order to understand the settings the diver must be aware of the theory of the gradient factors, M-values, inert gas pressure, etc!

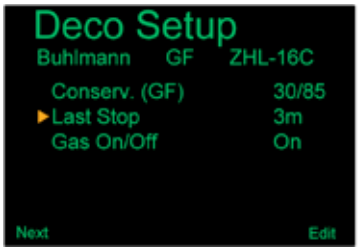
A range of articles on this subject can be found on the internet. The article by Eric C. Baker can be recommended in particular.If the settings are to be changed (edit mode) then it is necessary to push the right button "Edit".

First the low gradient factor is set (visible at the "GF Lo" display). Only one digit of the number is changed at a time. The ten's are always set first. Pressing the left button "Change" results in the displayed digit being increased by 1. After the digit has reached 9 it will revert back to 0 again. Pressing the right button "Next" once takes the diver to the units digit.

Now the high gradient factor is set (visible at the "GF Hi" display). Only one digit of the number is changed at a time. The ten's are always set first. Pressing the left button "Change" results in the displayed digit being increased by 1. After the digit has reached 9 it will revert back to 0 again. Pressing the right button "Next" once takes the diver to the units digit.

By pressing the right button "Save" the current settings are saved and edit mode is exited, and the user switches to the next entry. The current entry is marked with a "▶".

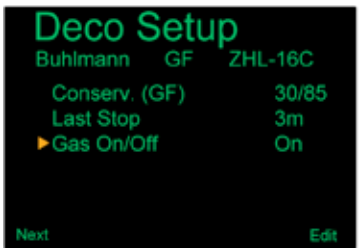
6.17.7 **Last Stop** (Deco Setup)



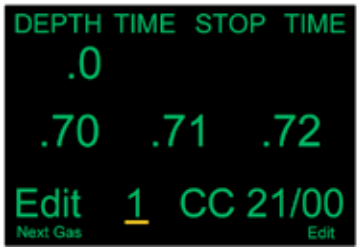
Using this menu item it is possible to define the depth of the last decompression stop. It is possible to set the last decompression stop at either 3 or 6 metres.

By pressing the right button "Edit" the user accesses the edit mode. In order to change the settings it is necessary to press the left button "Change" until the desired option is displayed. By pressing the right button "Save" the current setting is saved and the user switches to the next entry. The current entry is marked with a "▶".

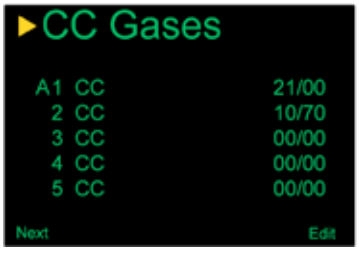
6.17.8 Gas On/Off. (Deco Setup)

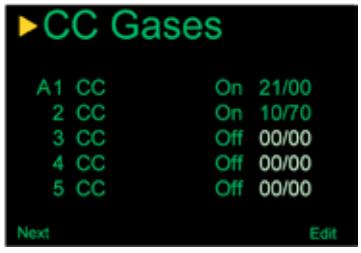


Using this menu item it is possible to switch alternative gas management on or off. Usually, all gases set (CC or OC mode) are used for the projection of the total Time To Surface (TTS). It is therefore essential to define only those gases in the gas list that are actually available. Any gases that are not available must be set to 00/00. This means 0% oxygen and 0% helium. If the alternative gas management is activated (=on) then gases that are not required can simply be switched off and switched on again if necessary. The possibility of switching individual gases on and off is available in the dive setup menu under the option "Define Gas", and in the system setup under "OC Gases" and "CC Gases". If alternative gas management is switched on then the display changes with the definition of the gases. The left image shows the setting of a breathing gas in the "Dive Setup" menu with alternative gas management deactivated (=off). The image on the right shows the same situation with alternative gas management active (=on).



By pressing the right button "Edit" the user accesses the edit mode. The first option here is to activate the respective gas. A gas that has not been activated is shaded grey. As soon as it is activated (=on), it is no longer shaded grey and the O2 and helium content of the gas can be adjusted in the normal way. As previously mentioned, the display in the "System Setup" also changes with "OC Gases" and "CC Gases". In the left image the alternative gas management is switched off and in the right image it is switched on.



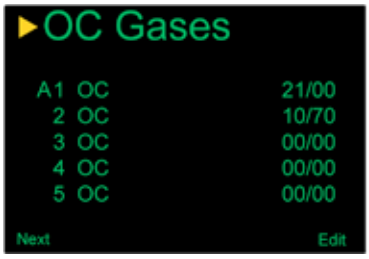


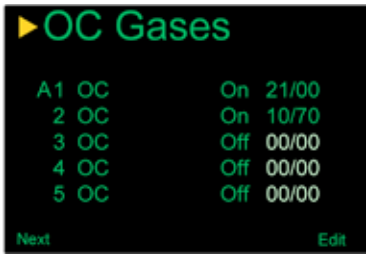
All gases that have not been activated are shaded grey. As soon as a gas is activated (=on), it is no longer shaded grey and the O2 and helium content of the gas can be adjusted in the normal way.

- With an active gas it is not possible to set the oxygen and helium content to 00/00. If the user attempts this then the controller automatically switches the gas to "Off".
- The current active gas (=A) cannot be switched to "Off". However, it is possible to adjust the oxygen and helium content.
- Identical gases in the same mode (OC or CC) are not possible.

6.17.9 OC Gases

The third submenu of the system setup is "OC Gases". Using this menu item it is possible to configure all 5 gases for the open circuit. In the left image alternative gas management is switched on. The individual options and configurations are identical to those in the "Define Gas" area, in the dive setup menu. However, all 5 gases are displayed simultaneously here.

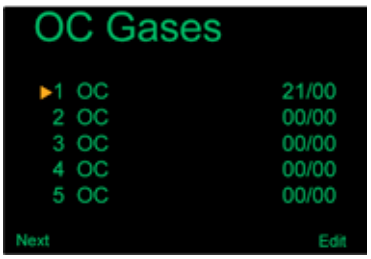




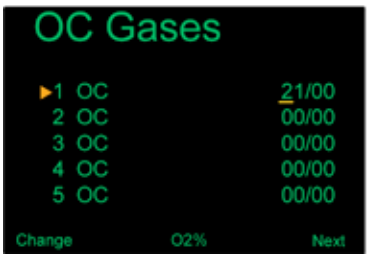
The sequence in which the gases are input is irrelevant. In the "Select Gas" menu all available gases are always displayed in order according to their O2 content (from the highest to the lowest).

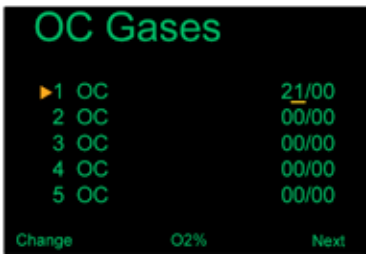
- If gases have the same O2 content then the gas with the lower helium content is brought to the front of the sequence.
- If alternative gas management is switched on (see chapter: 6.17.8) then an additional column is shown in the display, containing the gas status (on or off).

By pressing the right button "Edit" the user accesses the edit mode.

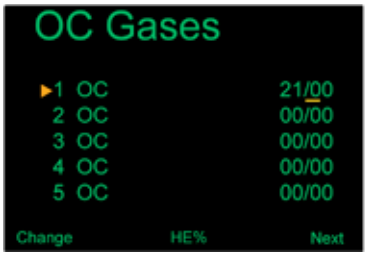


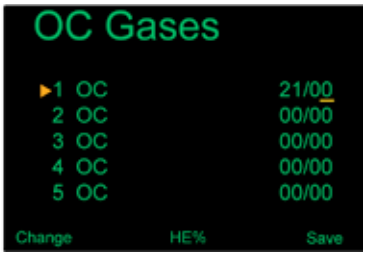
The "▶" symbol moves to gas number 1. By pressing the left button "Next", it moves to the next gas number. By pressing the right button "Edit" it is possible to adjust the gas.



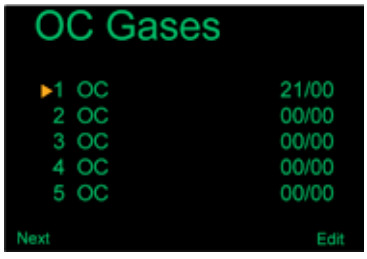


The O2 content of the gas is set first. Only one digit of the number is changed at a time. The ten's are always set first. Pressing the left button "Change" results in the displayed digit being increased by 1. After the digit has reached 9 it will revert back to 0 again. Pressing the right button (Next) once takes the diver to the units digit.





Next, the helium content of the gas is set. Only one digit of the number is changed at a time. The ten's are always set first. Pressing the left button "Change" results in the displayed digit being increased by 1. After the digit has reached 9 it will revert back to 0 again. Pressing the right button (Next) once takes the diver to the units digit.



Upon arriving at the units digit for the helium content it is possible to save the gas data by pressing the right button "Save", after which the user switches to the next entry. The current entry is marked with a "▶".

- The "A" in front of the gas number indicates the active gas. This cannot be deleted, i.e. setting 0% O2 and 0% helium generates an error message. However, the active gas can be adjusted at any time.

- The gases set are used for the projection of the total Time To Surface (TTS). It is therefore essential to define - or set to "on" - only those gases that are actually available.

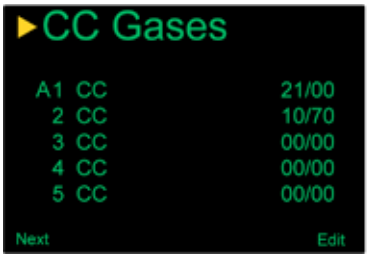
- If gases which are not available are defined or set to "on", this only has an influence on the preliminary calculation of the total Time To Surface (TTS). Decompression of the current active gas is always correctly calculated during the dive.

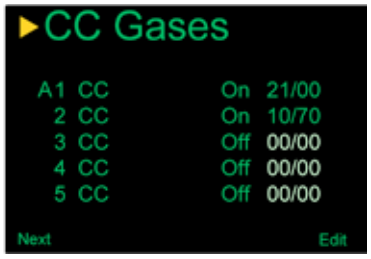
- All gases with 0% oxygen and 0% helium are automatically hidden in the "Select gas" menu.

- The gases can also be adjusted underwater at any time.

6.17.10 CC Gases

The fourth submenu of the system setup is "CC Gases". Using this menu item it is possible to configure all 5 gases for the closed circuit. In the left image alternative gas management is switched on. The individual options and configurations are identical to those in the "Define Gas" area, in the dive setup menu. However, all 5 gases are displayed simultaneously here.



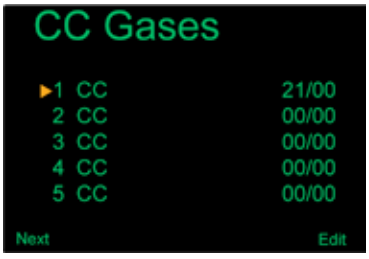


The sequence in which the gases are input is irrelevant. In the "Select Gas" menu all available gases are always displayed in order according to their O2 content (from the highest to the lowest).

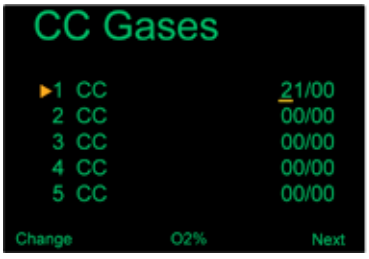
- If alternative gas management is switched on (see chapter: 6.17.8) then an additional column is shown in the display, containing the gas status (on or off).

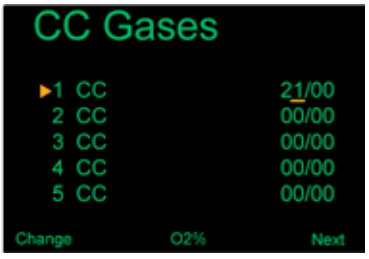
- If gases have the same O2 content then the gas with the lower helium content is brought to the front of the sequence.

By pressing the right button "Edit" the user accesses the edit mode.

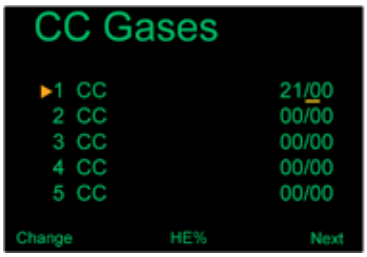


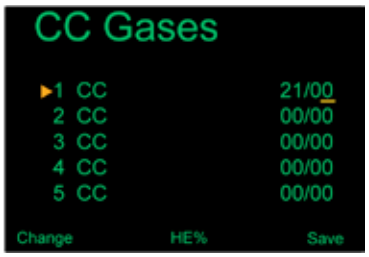
The "▶" symbol moves to gas number 1. By pressing the left button "Next", it moves to the next gas number. By pressing the right button "Edit" it is possible to adjust the gas.



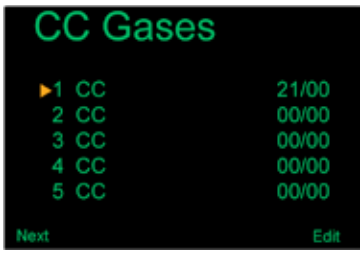


The O2 content of the gas is set first. Only one digit of the number is changed at a time. The ten's are always set first. Pressing the left button "Change" results in the displayed digit being increased by 1. After the digit has reached 9 it will revert back to 0 again. Pressing the right button (Next) once takes the diver to the units digit.





Next, the helium content of the gas is set. Only one digit of the number is changed at a time. The ten's are always set first. Pressing the left button "Change" results in the displayed digit being increased by 1. After the digit has reached 9 it will revert back to 0 again. Pressing the right button (Next) once takes the diver to the units digit.



Upon arriving at the units digit for the helium content it is possible to save the gas data by pressing the right button "Save", after which the user switches to the next entry. The current entry is marked with a " ▶ ".

- The "A" in front of the gas number indicates the active gas. This cannot be deleted, i.e. setting 0% O2 and 0% helium generates an error message. However, the active gas can be adjusted at any time.

- The gases set are used for the projection of the total Time To Surface (TTS). It is therefore essential to define - or set to "on" - only those gases that are actually available.

- If gases which are not available are defined or set to "on", this only has an influence on the preliminary calculation of the total Time To Surface (TTS). Decompression of the current active gas is always correctly calculated during the dive.

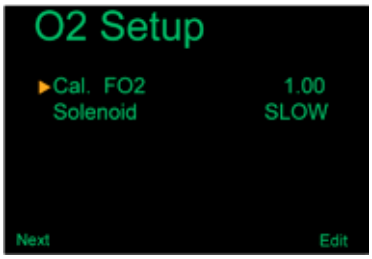
- All gases with 0% oxygen and 0% helium are automatically hidden in the "Select gas" menu.

- The gases can also be adjusted underwater at any time.

6.17.11 O2 Setup (overview)

The fifth submenu is "O2 Setup". Here, it is possible to implement oxygen-related settings.

6.17.12 Cal. FO2 (O2 Setup)



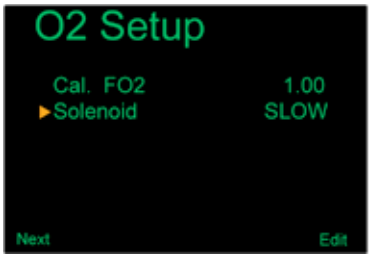
Using this menu item it is possible to change the calibration gas for the oxygen sensors.

By pressing the right button "Edit" the user accesses edit mode. After this it is possible to change the first digit by pressing the left button "Change". Pressing the right button "Next" results in a jump to the next digit. It is now possible to change this using the left button "Change". By pressing the right button "Save" the current value is saved and the user exits edit mode.

- If 100% oxygen is used, an FO2 of 1.00 should be set for calibration.
- As soon as the FO2 has been changed and stored, calibration of the O2 sensors is invalid and "FAIL" appears on the display in place of a number for all three sensors. PPO2 values are only displayed once again after successful calibration!

6.17.13 Solenoid (O2 Setup)

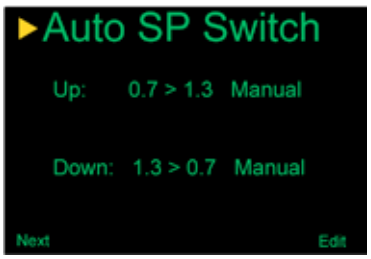
The solenoid response behaviour can be switched between "SLOW" and "FAST". With the JJ-CCR Rebreather the option "SLOW" should be selected as standard. This reflects a more classic response.



- With the option "FAST", the PPO2 can be more precisely maintained but the solenoid is operational more often in order to constantly supply small volumes of oxygen. This results in much higher use of the battery. Many divers also find the constant operating noise of the solenoid annoying.

By pressing the left button "Edit" the user accesses the edit mode. In edit mode, pressing the left button "Change" results in a switch between the "SLOW" and "FAST"settings. Pressing the right button saves the current setting.

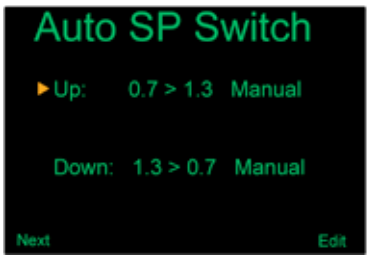
6.17.14 Auto SP Switch

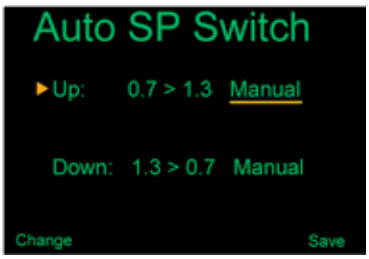


Using this menu item it is possible to activate or deactivate the automatic switching of the setpoint. In addition, it is possible to set the depth at which a switch from the low to high setpoint should take place (e.g. when descending) and the depth at which the reverse - from high to low setpoint - should take place (e.g. when ascending). It is naturally also possible to manually switch between the low and high setpoint if necessary, via the menu item "Switch Setpoint" (chapter 6.10).

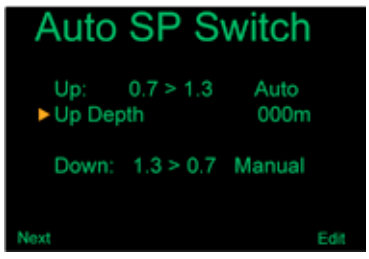
The following variants can be defined:

- Only SP UP (Low to High Setpoint) switched on
- Only SP Down (High to Low Setpoint) switched on
- Both Auto SP switched on
- No automatic setpoint switching.

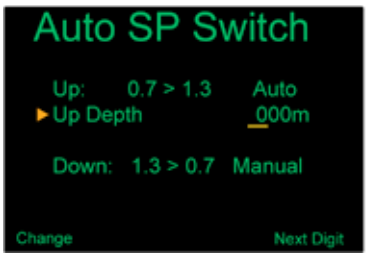


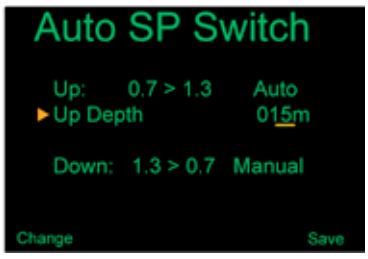


By pressing the left button the user accesses the edit mode. In edit mode, pressing the left button "Change" results in a switch between the "Auto" and "Manual" settings. Pressing the right button saves the current setting. With the "Auto" setting an additional line is displayed.



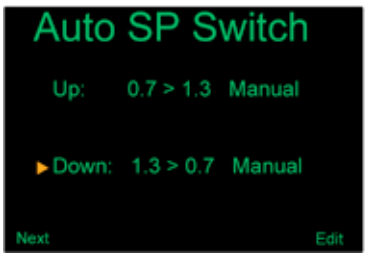
Here, the user now defines the depth at which the setpoint is to be switched automatically from low to high. By pressing the right button "Edit" the user accesses the edit mode.

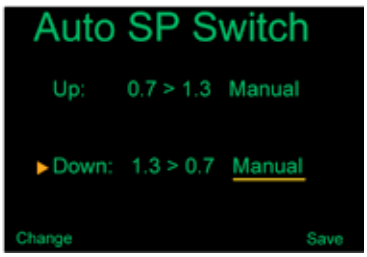




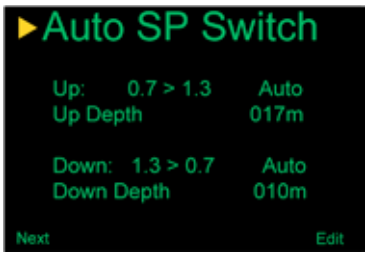
Pressing the left button "Change" results in the first digit (0-9) being changed. Pressing the right button "Next Digit" jumps the user to the next digit. Once the user accesses the last digit, pressing the right button "Save" results in the value being stored. Permissible values are 6-999 metres.

In the left image, the controller is configured such that it will switch from the low to the high setpoint at a depth of 15 m. During an ascent no automatic switching from high to low setpoint will occur.



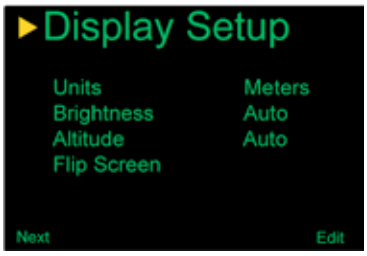


With "Down" it is possible to define the depth (when ascending) at which the controller switches from the high to low setpoint. The process of implementing the setting is identical. Permissible values are 2-999 metres.



In the image to the left, the controller will switch automatically from the low setpoint (.7) to the high setpoint (1.3) at a depth of 17 metres. When ascending, the automatic switching from the high setpoint (1.3) to the low setpoint (.7) will take place at 10 metres.

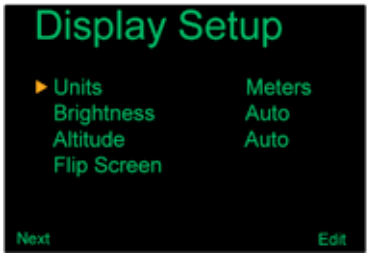
6.17.15 **Display Setup** (overview)

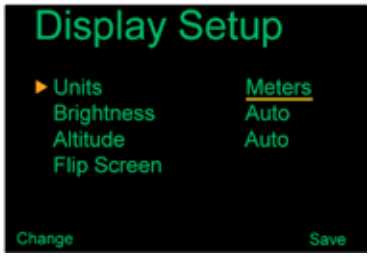


In this submenu it is possible to set all display options.

6.17.16 **Units** (Display Setup)

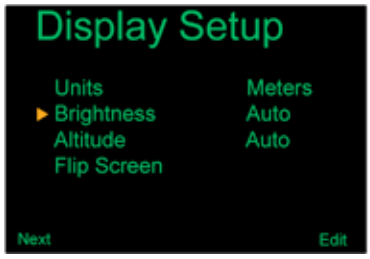
Via this menu item it is possible to switch the controller between "metres" and "feet".

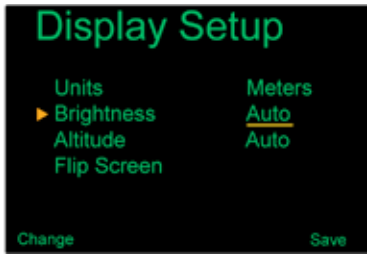




Setting the controller to metres or feet has an effect on the temperature display. If it is set to metres then the ambient temperature is displayed in degrees Celsius, whilst in feet this will be displayed in degrees Fahrenheit. In contrast, the time and date display does not change. These are always in hours/minutes and month/day/year.

6.17.17 **Brightness** (Display Setup)





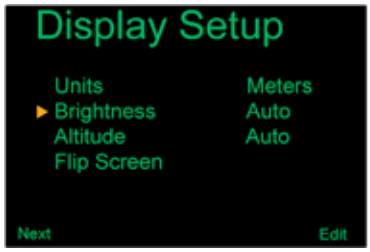
Using this menu item it is possible to set the brightness of the display. Pressing the right button "Change" switches the mode.

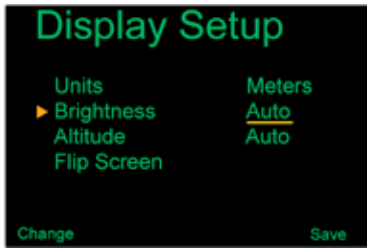
Four different modes are available for selection:

Mode	Description
Auto	The brightness sensor measures the ambient light and automatically adjusts the brightness of the display.
Low	Permanent minimum brightness
Med	Permanent medium brightness
High	Permanent maximum brightness

- The higher the brightness, the higher the battery consumption! It is therefore recommended that the "Auto" mode be used.

6.17.18 **Altitude** (Display Setup)



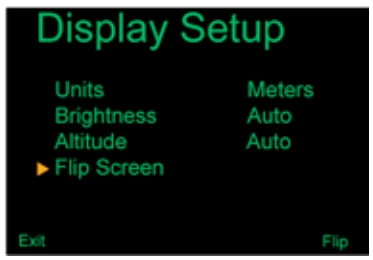


Via this option it is possible to switch the automatic altitude adjustment on or off. If this option is set to "Auto" then automatic altitude adjustment (mountain lake mode) takes place for decompression and with the calibration of the O2 sensors. If all dives take place at sea level then the user can select "SeaLvl". This results in a surface pressure of 1013mBar being selected every time.

- In the case of dives above sea level, this option must be set to "Auto". The standard setting ex works is "SeaLvl"!

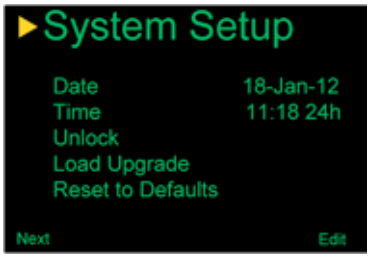
- In the case of dives above sea level, the controller must be switched on at the surface! If the controller only switches itself on underwater due to pressure, it does not know the actual surface pressure and always assumes 1013mBar in this case! This can result in an erroneous decompression calculation!

6.17.19 **Flip Screen** (Display Setup)



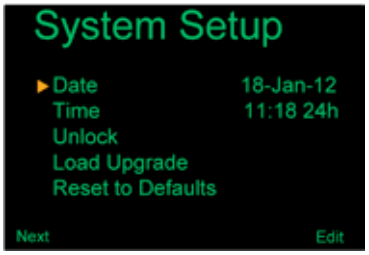
Via this menu item it is possible to flip the controller display through 180 degrees. The assignment of both buttons is also flipped through 180 degrees!

6.17.20 System Setup (overview)



In this submenu it is possible to implement various system settings.

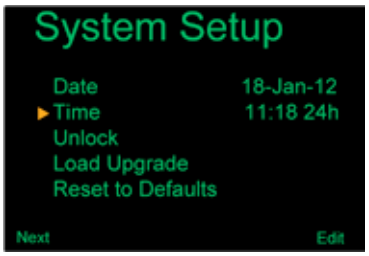
6.17.21 Date (System Setup)



Using this menu item it is possible to set the current date. The date is used for the controller logbook. The sequence is: Day/month/year.

- The date and time is displayed with the status information (see chapter 6.18).

6.17.22 Time (System Setup)



Using this menu item it is possible to set the current time. The time is used for the controller logbook. The time can be displayed in AM/PM or as 24 hour format.

- The date and time is displayed with the status information (see chapter 6.18).

6.17.23 Unlock (System Setup)

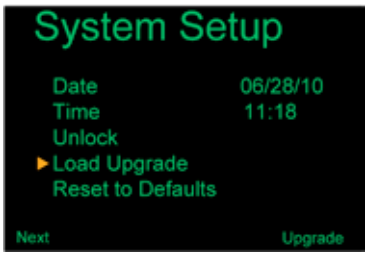
This menu item enables the entry of a code in order to release additional controller functions.

- Note: This function is intended for possible future expansions. At the current time there are no additional functions available for activation.

Pressing the right button "Unlock" displays a line with numerous "0". Pressing the left button "Change" facilitates changing the current character. Possible numbers and letters are 0-9 and A-F. Pressing the right button results in a jump to the next character. Once the user accesses the last character, pressing the right button results in the unlock code being stored and implemented.

An incorrect unlock code is not accepted by the controller and is rejected.

6.17.24 Load Upgrade (System Setup)



Via this menu item it is possible to update the controller's firmware. A PC or Apple "Mac" with Bluetooth interface is required for this purpose. The precise process is described in chapter 6.21.

- The specific modifications to the JJ-CCR firmware are contained in the regular firmware of the controller manufacturer.
- **IMPORTANT:** An upgrade to new firmware can only be carried out if we have approved this for the JJ-CCR Rebreather!

6.17.25 Reset to Defaults (System Setup)

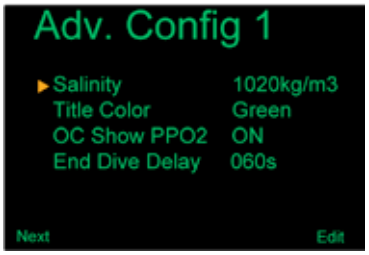
The option resets all controller settings to the factory settings. The current tissue saturation is also deleted here.

- This option deletes neither the internal logbook nor the dive numbers.

6.17.26 Advanced Config (overview)

This sub-menu allows changes for values that will not need frequent adjustment. At the top level menu, you can either enter the "Advanced Configuration" or reset the "Advanced Configuration" values to their defaults.

6.17.27 Salinity (Advanced Config 1)

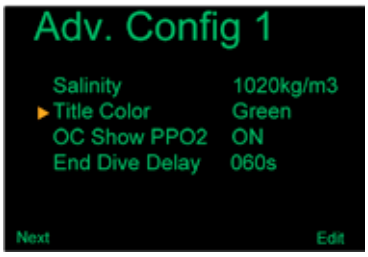


The salinity setting sets the density of water in kilograms per cubic meter (kg/m3). A cubic meter of pure water weighs 1000 kg. Therefore, this value sets the weight of the dissolved salts in the water. For example, a value of 1030 kg/m3 means there are 30 kg of salts per 1000 kg of water.

- Since the depth sensor actually measures pressure, this value affects the displayed depth. Note that decompression profiles are computed using the actual measured pressure (and not the somewhat arbitrary depth).
- It is recommended to use the default settings.

Values	Description
1000kg/m³	Fresh Water
1020kg/m³	EN13319 value, JJ-CCR controller default (between fresh and salt water)
1025kg/m³ - 1035kg/m³	Salt water (Varies by location)

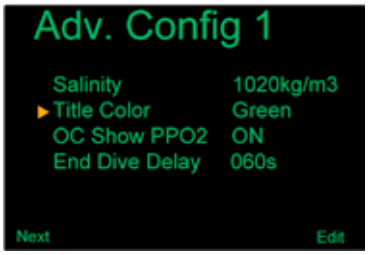
6.17.28 **Title Color** (Advanced Config 1)



The tile colours can be changed for added contrast or visual appeal. The default colour is green.

The available colours are: cyan, gray, blue and green.

6.17.29 **OC Show PPO2** (Advanced Config 1)



This setting has no effect on the JJ-CCR controller.

6.17.30 **End Dive Delay** (Advanced Config 1)

This option sets the time in seconds to wait before ending the current dive. This value can be set from 20 seconds to 600 seconds (10 minutes). The default value is 60 seconds. Since the controller can stay in dive mode for a longer time, a new "End Dive" menu option has been added (Chapter: 6.10). This is the first menu option when the controller is still in dive mode and when the diver is at the surface.

6.17.31 Advanced Config 2 (overview)

The "Advanced Config" page 2 allows the changing of the PPO2 limits.

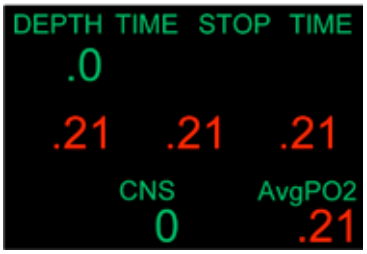
WARNING: Do not change these values unless you understand the effect

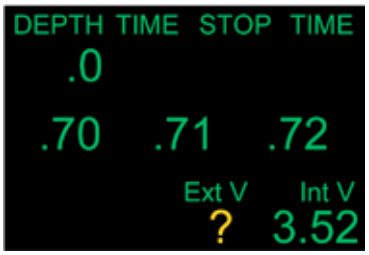
- A "Low PPO2" or "High PPO2" alert is displayed when the limits are violated for more than 30 seconds.

PPO2 Limits	Description
OC Min. PPO2	PPO2 displays in flashing red when less than this value. The default is 0.19.
OC Max. PPO2	PPO2 displays in flashing red when higher than this value. The default is 1.65.
OC Deco PPO2	The decompression predictions (TTS and NDL) will assume that the gas in use at a given depth is the gas with the highest PPO2 that is less than or equal to this value. Also, the suggested gas switches (when the current gas is displayed in yellow) are determined by this value. If you change this value, please understand its effect. For example, if lowered to 1.50, then oxygen (99/00) will not assumed at 20ft/6m. The default is 1.61.
CC Min PPO2	PPO2 displays in flashing red when less than this value. The default is 0.40.
CC Max. PPO2	PPO2 displays in flashing red when higher than this value. The default is 1.60.

6.18 Status information

If the right button is pressed in the main display then various status information appears in turn in the information line at the bottom of the display. The first two items of status information depend on whether the controller is in OC mode (open circuit) or CC mode (closed circuit).

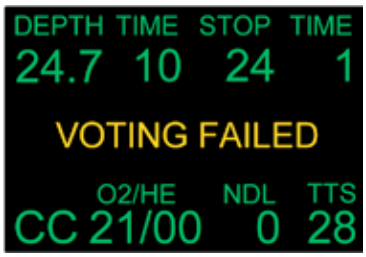
Status information	Description
CC mode OC mode  	**DilPO2:** Displays the current PPO2 of the diluent. If the value is lower than 19 or higher than 1.65 then it flashes red. **CNS:** Shows the current CNS saturation as a percentage: From 100% or above, the value flashes red. The CNS saturation is calculated constantly, also at the surface and even if the computer is switched off. In the event of a battery change the CNS saturation is deleted! **SP:** Displays the current active setpoint. The setpoint .19 is displayed in yellow. All other setpoints in green. **AvgPO2:** Indicates the average PO2 of the breathing gas. The basis for calculation is the average of the measured values of all sensors which have not been excluded. If the value is lower than .40 or higher than 1.60 then it flashes red. **CNS:** Shows the current CNS saturation as a percentage: From 100% or above, the value flashes red. The CNS saturation is calculated constantly, also at the surface and even if the computer is switched off. In the event of a battery change the CNS saturation is deleted! **AvgPO2:** Indicates the average PO2 of the breathing gas. If the value is lower than .19 or higher than 1.65 then it flashes red.
CC and OC mode 	Indicates the current millivolts of the connected O2 sensors.
CC and OC mode 	**MAX:** Indicates the maximum depth of the current dive. When not in dive mode, the maximum depth of the last dive is displayed here. **AVG:** Indicates the average depth of the current dive. When not in dive mode, the average depth of the last dive is displayed here. **AvgATM:** Indicates the average depth of the current dive in absolute pressure (= 1.0 ATM equals sea level).

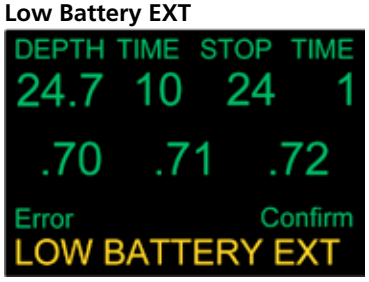
Status information	Description
CC and OC mode 	**TEMP**: Shows the current temperature in degrees Celsius. **GF:** Shows the set low and high gradient factors. **FiO2:** Shows the oxygen concentration of the breathing gas. This value is independent of the ambient pressure!
CC and OC mode 	**GF99:** Shows the current M-value gradient as a percentage. If no outgasing is taking place, "On Gas" is displayed. **CEIL:** Indicates the upper limit of the ceiling in metres. **@+5:** Indicates the new TTS if the diver were to stop for 5 further minutes at the current depth. **TTS:** Shows the current TTS
CC and OC mode 	**Ext V:** Indicates the current voltage of the battery for the solenoid under load in volts. When not under load, the value may be incorrect and much too high, providing an entirely inaccurate picture of the battery condition. If, in place of a value a "?" is displayed then this shows that the solenoid has not yet been actuated and the controller has been unable to carry out any measurement. If the voltage of the batteries is very low then the value is displayed in red. **Int V:** Shows the current voltage of the controller battery in volts. The value is displayed in yellow if the battery is almost empty and requires replacing. If the value is displayed in red then the battery voltage is critical and the battery should be replaced immediately.

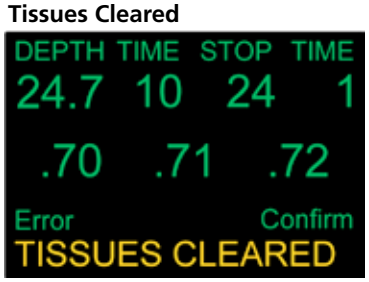
Status information	Description
CC and OC mode 	**Surf:** Shows the surface pressure in mBar. The pressure is measured when switched on, and saved until the controller is switched off again. If the automatic altitude adjustment is switched off (altitude = SeaLvl) then 1013 mBar is always displayed. The value is generally only displayed at the surface. This means when the controller is not in dive mode. **Now:** Shows the current ambient pressure in mBar. This value is also displayed in dive mode.
CC and OC mode 	**Date:** Displays the current date (mm/dd/yy) **Time:** Displays the current time (hh/mm)
CC and OC mode 	**Surface Interval:** Displays the current surface interval since the last dive. This information can be used for planning repetitive dives.
CC and OC mode 	**Serial No:** Shows the controller serial number. **Version:** Shows the model and firmware version of the controller. The first digit identifies the model: 1 = PPO2 display, 2 = computer and 3 = controller. The next 4 digits are for certain configurations. For example, whether helium is active as a breathing gas or not. The last two digits stand for the installed firmware version.

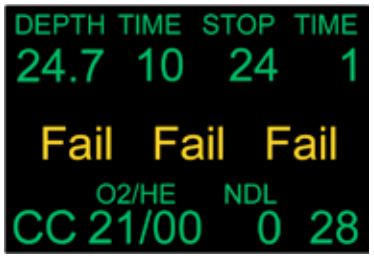
6.19 Alarm and error messages

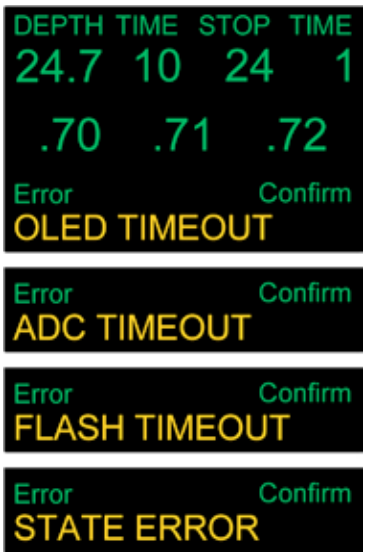
All alarm and error messages on the controller must always be confirmed. Only then will they disappear from the display.

Alarm and error messages	Description
Cell Warning 	If the measured value of an O2 sensor exhibits too high a deviation then this is excluded during the calculation of the average PPO2 (necessary for the calculation of decompression) and it flashes **yellow**. If the deviation between all three sensors is so high that all three sensors must be excluded then all values flash **yellow** and the notification "VOTING FAILED" appears at alternate intervals.
Switch Gas 	If the current gas is displayed in **yellow** then this is an instruction to implement a gas change because a better gas (PPO2) is available in the gas list. The controller uses all defined gases for the TTS calculation. It is necessary to change immediately to the other gas or remove the gas from the gas list because it is otherwise no longer possible to calculate the correct TTS. Gases can also be changed and/or added underwater at any time!
High PPO2 	The high "HIGH PPO2" alarm message appears if a PPO2 of 1.60 has been exceeded for more than 10 seconds. With the first warning it is necessary to confirm this by pressing the right button. If, during the same dive, the PPO2 should once again be too high then it is not necessary to confirm this again (see second image). The PPO2 values and the "High PPO2" warning flash in red.

Alarm and error messages	Description
Low PPO2 	The "LOW PPO2" alarm message appears if the PPO2 is lower than .40 for more than 10 seconds. With the first warning it is necessary to confirm this by pressing the right button. If, during the same dive, the PPO2 should once again be too low then it is not necessary to confirm this again (see second image). The PPO2 values and the "Low PPO2" warning flash in red. Another cause for this alarm message is shown in the second image. Two sensors with comparable values are not available. It is therefore not possible for the controller to determine which value is correct, and the actual PPO2 is thus unknown. In this instance the average PPO2 is calculated as 0.00. Because 0.00 is lower than 0.40, the "LOW PPO2" alarm message will also appear.
Low Battery EXT 	This alarm message appears if the voltage of the two batteries for the solenoid is too low. The solenoid continues to function, but the batteries must both be replaced prior to the next dive.
Low Battery INT 	This alarm indicates that the controller battery must be replaced immediately. It appears if the battery voltage drops below 3.2 volts for more than 30 seconds. The battery symbol also flashes red.

Alarm and error messages	Description
Solenoid Alert 	If this alarm appears, it is necessary to implement the appropriate measures immediately. It indicates that the solenoid is working from the perspective of the controller, but that the PPO2 in the circuit is not changing. A possible cause for example, is that no more oxygen is present in the tank. With the first warning it is necessary to confirm this by pressing the right button. If, during the same dive, an identical problem should once again arise then it is not necessary to confirm this again (see second image). The PPO2 values and the "Solenoid!" warning flash in red.
Fast Ascent 	The "Fast Ascent" alarm message appears if the diver ascends very quickly within a short space of time, or if his speed has been faster than 20 metres per minute for longer than one minute.
Missed Deco Stop 	The "Missed Deco Stop" alarm message appears if the diver exceeds the minimum depth of the current decompression stop for more than one minute.
Tissues Cleared 	The "Tissues Cleared" alarm message appears in the event of a power loss (for example with an empty battery, following a battery change) or after a firmware upgrade. The message indicates that all current tissue calculations have been deleted. A minimum of 24 hours should therefore be allowed before the next dive.

Alarm and error messages	Description
Watchdog Reset 	This alarm appears if the controller is unable to execute all tasks within a predefined time. This may be a temporary problem that occurs from time to time (e.g. brief loss of battery voltage). However, it may also be a hardware problem. The circumstances of a Watchdog Reset should be recorded and the manufacturer informed of these for further clarification.
Upgrade Reset 	This message always appears after every successful firmware update. It indicates that the controller has been started with new firmware.
Needs Cal. 	This message appears after a firmware update of the controller. "Needs Cal." and "Fail, Fail, Fail" are alternately displayed. This means that the oxygen sensors must be calibrated.
Brownout Reset 	This error message appears if the battery is fully depleted in standby mode. The controller cannot function correctly, even in standby mode, and a system reset is implemented.

Alarm and error messages	Description
Internal Hardware Failures 	The following error messages relate to internal hardware failures. The controller attempts to eliminate these, but it is generally the case that something has happened that should not have occurred. These error messages should always be recorded and the nearest service centre duly informed. This is not an exhaustive list of all internal hardware error messages.

6.20 Changing the batteries

A 3**.6 volt lithium AA battery** (SAFT 14500) is used in the JJ-CCR controller!

- 1.5 Volt alkaline or lithium AA batteries, or 1.2 volt rechargeable AA batteries must NOT be used in the controller!

- In the event of a battery change all of the current tissue calculations will be lost (= Tissues Cleared alarm message). It is therefore recommended that the batteries be changed in good time, i.e. before a dive safari.

In order to change the battery it is first necessary to open the battery compartment (ideally using a coin).

Now, carefully lift the battery retainer out of the housing.
The easiest way to remove it is to use a paperclip as a hook.

It is then possible to remove the old battery and insert the new battery. It is normal for the controller to switch itself on automatically at this point! The battery retainer is hard-wired.

Push the wire into the battery compartment before inserting the battery retainer. Align the flat edge of the battery retainer towards the button and then carefully sliding the battery retainer into the battery compartment.

- It is essential to ensure that the cables do not become pinched and/or damaged!

Before screwing the battery compartment lid back in place, check its O-ring. This must be in good condition and should be very lightly greased. The battery compartment lid must be screwed on until hand-tight. A coin can once again be used for this purpose.

6.21 Firmware update

The controller's firmware can be self-updated The version currently installed is visible on the status information display (see chapter 6.18). In this example, firmware version 37 is installed on the controller.

The most recent version of the firmware can be found on our homepage or on the homepage of the controller manufacturer. The name of the file indicates the version (e.g. the file Predator_V46.aes is firmware version 46).

- The specific modifications to the JJ-CCR firmware are contained in the regular firmware of the controller manufacturer.
- IMPORTANT: An upgrade to new firmware can only be carried out if we have approved this for the JJ-CCR Rebreather!

It is necessary to allow approx. 30 minutes for the update of firmware. In order that no problems arise during the update, the controller works using two memory banks for assurance purposes. This prevents the controller from becoming unusable if any problems should arise with the transferral of the new firmware data. For example, due to a poor connection or crashing of the Windows computer. New firmware is therefore initially transferred to dedicated memory. Here, this is decrypted. If everything is OK then the new firmware is transferred to the active memory and only then does the actual update take place. This means that if an update is interrupted at any time, for any reason, then the old firmware and its settings will be retained.

- In order to upgrade the firmware the user requires a computer with a Windows operating system (XP – Service Pack 2 or 3, VISTA or Windows 7) or an Apple Mac (Intel Core Duo) with OS X 10.4.9 or higher.

- The latest version of the "Shearwater Desktop" Software must be installed on the computer.

- Windows systems: The USB Bluetooth adapter provided must be connected to the computer and Windows must have the correct driver installed for this (Original Windows Bluetooth or WidComm driver). Other Bluetooth drivers such as those from Toshiba do not work with the software!

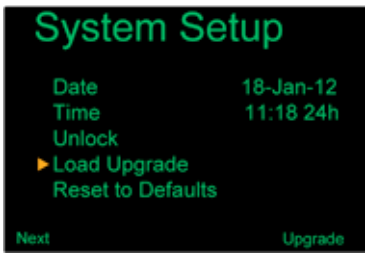
- Apple Mac: All Apple Macs have an integrated Bluetooth interface that can be used for the firmware update The USB Bluetooth adapter provided is not compatible with Apple systems and must not be used.

6.22 Step-by-step Firmware Update

NOTE: Before upgrading, please download all existing dive logs.
The following chapter provides a step-by-step description of the firmware update. The images show the upgrade with a Windows system. The process is identical with an Apple Mac.

- Download the latest firmware and store this file on the computer (e.g. Predator_V46.aes).
- Now start the Shearwater Desktop Software.
- In the "Dive Computer" menu select the option "Update Firmware".

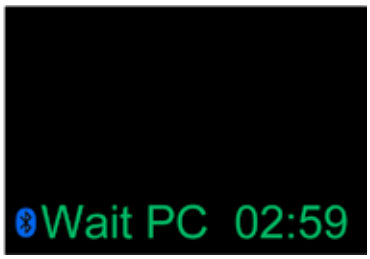
Now click on "Select File..." and select the file with the new firmware (ending = EAS) from the pop-up window.



Now switch the controller on. In order to prevent constant solenoid triggering, it is possible to set the setpoint to .19.

Enter the "System Setup+" menu. Click on the left button (Menu) until you are in the "System Setup" menu.

Go to the "Load Upgrade" option and press the right button "Upgrade" in order to start the ready mode for the data transfer.



The information appears, showing that the Bluetooth interface on the controller has been activated. Once the interface is active, the message "Wait PC" appears and a three-minute timer starts. Within these three minutes it is necessary to establish a Bluetooth connection. If the timer runs, out, the Bluetooth interface in the controller will be switched off again. You can now click on "Start". The Shearwater Desktop Software searches for a controller in its environment. It may take a few seconds for the connection to be established.

Once the Bluetooth connection is established, the new firmware is transferred to the controller.

Once all data has been transferred, the Bluetooth connetion is closed automatically and the controller starts to decrypt the new firmware. A progress bar indicates progression. This process can take up to 30 minutes. Only once this process is complete has the actual firmware update on the controller finished. Once the firmware has been updated the controller automatically starts up again.

The alarm message "Tissues Cleared" is issued. Following this message, an "Upgrade Reset" message is shown. Both messages must be confirmed by pressing the right button.
The firmware update has now been successfully completed.

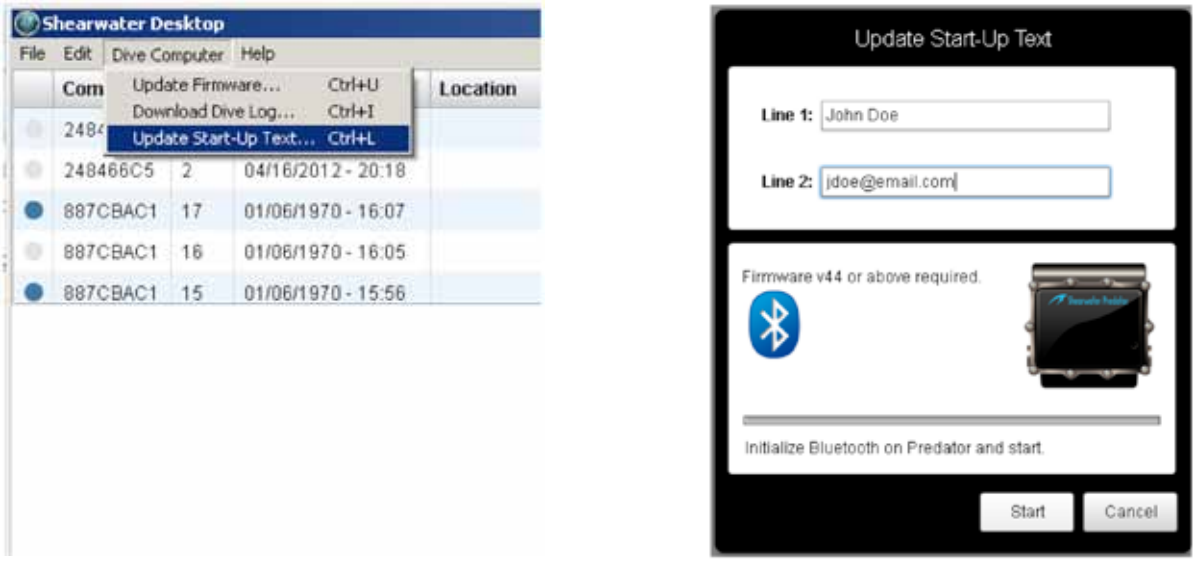
• Following a firmware upgrade it is always essential to carry out calibration of the oxygen sensors.

6.23 Startup Text

From Firmware update v.46; text can be added to the startup screen. The Shearwater Desktop computer application is used to program the custom text in the Predator via Bluetooth.

Up to 2 lines of 21 characters per line can be displayed. The text may cover part of the logo, depending on the text and logo.

Custom Text Added to the Startup Screen



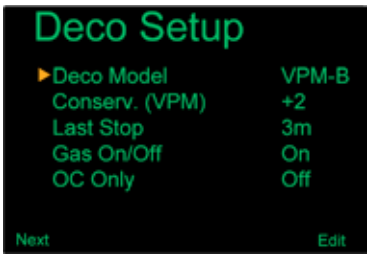
Use the Shearwater Desktop Application to Update Startup Text

7 VPM-B / VPM-GFS decompression model

Additionally to the standard Bühlmann GF decompression model, you can also use VPM-B or VPM-B/GFS as decompression model on your JJ-CCR controller. The unlock code for the VPM-B must be purchased and requires the firmware 42 or higher installed.

- The VPM-B calculations on the JJ-CCR controller run every 5 to 10 seconds. This means the JJ-CCR controller will best match a desktop planner (like VPlanner) when the minimum stop time is set to 10 seconds.

7.1.1 Deco Model



You can choose between three decompression models.

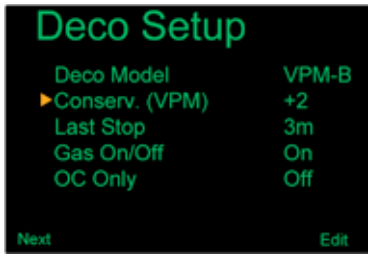
Model	Description
GF	Bühlmann GF
VPM-B	VPM-B
VPM-BG	VPM-B/GFS

The Gradient Factor Surfacing (VPM-BG) option adds conservatism to the shallow stops on dives with significant decompression requirements (typically > 1 hour deco). The GFS extension automatically chooses the decompression ceiling from the more conservative of the VPM-B profile and a Bühlmann ZHL-16C profile. For the Bühlmann profile a single gradient factor, adjustable over a range of 70% to 99%, is used.

- The selected decompression model is automatically used within the "Dive Planner (Chapter: 6.14.4)
- Within the status information display it shows the used decompression model and the selected gradient factors or conservatism.

7.1.2 Conserv. (VPM)

You can choose between three decompression models.



Model	Conservatism
VPM-B	The adjustable conservatism is from 0 to +5. Higher numbers create more conservative (longer decompression) profiles. The most aggressive setting is 0, and the most conservative is +5. The default is +3.
VPM-B/GFS	The VPM-B/GFS allows you to adjust the conservatism from 0 to +5. Additionally you can adjust the GFS value. For the GFS value, higher values are less conservative. The most aggressive setting is 99% and the most conservative is 70%. The default value is 90%.

- It is possible to change the conservatism during the dive within the "Dive Setup" menu (Chapter 6.14.5).

8 Checklist prior to diving

This chapter contains a complete checklist for the JJ-CCR Rebreather prior to a dive. It is essential that the diver run through this checklist prior to every dive.

- If the diver does not run through the checklist then there is a possibility of entering the water with equipment that is not suitable for diving, which can result in severe risks to health.

8.1 Preparations on land

Step	Description
1	**Do I feel, healthy, well and calm?** If not, it is best not to dive!
2	**Is the soda lime canister filled with new soda lime that has never been used? Soda lime that has already been used must never be used for another dive.**
3	Analyse the contents of the diluent and oxygen tanks. Also check whether sufficient pressure is present for the planned dive.
4	**Never forget to carry an adequate Bailout system for the dive**. When calculating the required Bailout system, always assume the worst case scenarios. You can never take too much Bailout gas with you!
5	Secure the tanks (O2 and diluent) to the Rebreather.
6	Place the lid with the soda lime canister into the aluminium housing.
7	Carry out a positive and negative pressure test on the lid.
8	Connect all hoses. Take care to ensure that the O-rings are clean. Always check that the BOV shutter valves are functioning correctly in the breathing hose.
9	Open both tank valves and check the tank pressure.
10	**Check the medium pressure of both first stages. The diluent must exhibit a medium pressure of 9.0 to 10.0 bar, whilst in the case of the oxygen this must be 7.0 – 7.5 bar. It is prohibited to dive using the equipment if these values are not correct!**
11	Check the manual supplemental valves and ADV to ensure they are functioning correctly.
12	Check the wing inflator to ensure it is functioning correctly.
13	Check the DSV (Dive Surface Valve) to ensure it is functioning correctly.
14	Carry out a positive pressure test: Fill the circuit fully with air via the mouthpiece, until the overpressure valve of the counter lung triggers. Close the mouthpiece and wait a few minutes. Now open the mouthpiece again. If the system still contains overpressure then you will hear the gas escaping upon opening the mouthpiece.
15	Actuate the fast drain valve on the counter lung in order to ensure that it functions correctly.
16	Carry out a negative pressure test: Close both tank valves. Using the mouthpiece, generate a vacuum in the circuit. A clear sign of a vacuum is the position of the ADV membrane. Close the mouthpiece and wait. If the position of the ADV membrane does not change, the test has been successful. As soon as you open the mouthpiece again you should also hear the noise of air being drawn in.

17	Open both tank valves again.
18	Open the mouthpiece (=CC mode).
19	Switch the HUD and the controller on.
20	Calibrate the oxygen sensors with the controller and then with the HUD.
21	Breathe for 2-3 minutes from the device, in order to check that the soda lime is functioning correctly.
22	Close the mouthpiece (OC mode).
23	Switch off the controller and the HUD.
24	Close both tank valves.

8.2 Shortly prior to diving

Step	Description
1	Open both tank valves and check the tank pressure.
2	Check the manual supplemental valves and the ADV.
3	Check the wing inflator.
4	Check the DSV (Dive Surface Valve) to ensure it is functioning correctly.
5	Carry out a positive and negative pressure test.
6	Switch the HUD and the controller on.
7	Check the setting of the low and high setpoint on the controller.
8	Open the mouthpiece and breathe for at least 2-3 minutes.

8.3 Shortly after entering the water

Step	Description
1	Carry out a bubble check within the first 6 metres of descending. Never start a deeper descent without carrying out this check.
2	Check the display on the controller and HUD.
3	Check that the equipment is correctly positioned and that everything is stored in the right place.

9 Diving

The most important rule when diving is: Always know your PPO2 at all times! With the JJ-CCR this can be read out from the HUD and/or the controller. In order to be certain that both systems are working correctly, the diver should also check regularly to ensure that both instruments are displaying the same values. The optimum water position requiring the minimum breathing effort is at an angle of 20 - 30 degrees. This means that the head must be somewhat higher than the legs. Breathing should be deep and even at all times. In general terms, the volume in the breathing circuit should be as low as possible. Too great a volume has a negative effect on the breathing effort and buoyancy. The volume in the breathing circuit is perfect if breathing in does not quite trigger the ADV.

10 After the Dive

This chapter contains details of all steps that should be carried out with the JJ-CCR Rebreather after the dive. Please carry out these steps after every dive:

Step	Description
1	**Never close the tank valves before you take off the Rebreather.**
2	Switch the controller off and dry the water contacts.
3	Switch off the HUD.
4	Close both tank valves.
5	Remove the breathing hose with the DSV.
6	Remove the lid with the soda lime canister from the aluminium housing.
7	Remove the soda lime canister from the lid.
8	Leave the lid and the soda lime canister to dry.

Steps 5-8 are only necessary if the diver is planning no further dives the same day.

11 Cleaning

It is possible to carry out "quick" or "complete" cleaning of the JJ-CCR Rebreather.
"Quick" cleaning is completed rapidly and can also be carried out between two dives.

11.1 "Quick" cleaning

The following steps should be carried out for "quick" cleaning:

Step	Description
1	Remove the breathing hose with the DSV and rise it with water. Attention: Excessive water pressure must be avoided as this can damage the shutter valves.
2	Add water to the counter lung via the T-piece – ATTENTION ONLY ON THE EXHALATION SIDE. Remove the water by actuating the fast drain valve.
3	Remove the lid with the soda lime canister from the aluminium housing.
4	Remove the soda lime canister from the lid.
5	Leave the lid and the soda lime canister to dry.

11.2 "Complete" cleaning

Complete cleaning should be carried out every day, in particular in warmer regions.

Step	Description
1	Remove the lid with the soda lime canister from the aluminium housing.
2	Remove the soda lime canister from the cap.
3	Leave the lid and the soda lime canister to dry.
4	Remove the counter lung with the breathing hose.
5	Spray a little disinfectant (e.g. JJ-CCR Clean) into the T-pieces.
6	Fill the counter lung and breathing hose with water and wait a few minutes (in accordance with the specifications for the disinfectant).
7	Empty the counter lung and breathing hose. Rinse everything once more with fresh water. The simplest way to do this is to remove the breathing hose from the counter lung and rinse both through separately.
8	Leave everything to dry overnight. The counter lungs dry best if rotated 180 degrees and hung up, so that the T-pieces point downwards.

Two short hoses are located on the lid. It is not necessary to clean these so frequently. This can be carried out after a period of a number of weeks without cause for concern. It is important that the lid is always stored such that these two hoses are able to dry out well during a dive. If necessary it is also possible to rinse the hoses out on the exhalation side using water. In order to do so, hold the lid at a slight angle so that thewater can drain out directly. Never rinse the inhalation side in the same way because the oxygen sensors will be immersed in water.

When carrying out complete cleaning it is naturally also possible to remove both hoses. In order to do so, remove the screw with the washer located between the two hoses (see chapter 5.1.4)

12 Storage

When storing the JJ-CCR Rebreather it is essential to choose a dry, shady and well ventilated location. Avoid any unnecessary UV radiation. All parts of the breathing circuit must be disinfected thoroughly prior to storage, and the soda lime canister must be emptied. In order to prevent the penetration of living creatures and/or other foreign particles, the equipment must be assembled for storage. Ensure that the DSV (Dive Surface Valve) is closed. The lid with the soda lime canister must not be placed fully in the aluminium housing. The following image shows the correct position:

If the lid is inserted fully with the soda lime canister and remains in this position for an extended period then it is possible, in certain circumstances, that it will be necessary to apply extensive force in order to remove it.

13 Maintenance

13.1 General Care

As with all technical equipment, the JJ-CCR Rebreather should always be treated with care. General care also includes observing the maintenance intervals and regularly checking the general condition of the equipment. For example, the O-ring grease.

13.2 Maximum Service Life

If the maintenance intervals are observed, there is theoretically no given maximum service life. However, the user should be aware that rubber and plastic parts do age, and that this process is accelerated by exposure to direct sunlight. If these parts are not replaced during standard maintenance works then the following maximum service life figures apply:

Service life	Part(s)
10 years	All rubber parts – Breathing hose, mouthpiece, O-rings, etc.
10 years	Counter lungs – without outer liners
10 years	Diluent hoses – High pressure and middle pressure
5 years	Oxygen hoses – High pressure and middle pressure
1 years	Oxygen sensors

Decisive here is the production year of the equipment. This information can be found on the type plate. For example "Mfg Date: 11/07" stands for the year 2011 and the month of July. If the parts have not been replaced at an earlier date during maintenance then they must be replaced no later than upon reaching this date. Exceptions here are the oxygen sensors. In this case a service life of one year applies from the date of production printed on them.

13.3 Approved care products

The following care products can be used:

Care product	Description
Grease	**Molykote 111:** This can be used for greasing all breathing circuit elements. **Halocarbon 25-5S:** This can be used for greasing all parts conducting at medium pressure.
Desinfection	**JJ-CCR Clean** or **Buddy Clean** can be used as disinfectants.
Cleaning	For general cleaning (e.g. after use in seawater) normal tap water should be used.

13.4 Care Intervals

The following equipment care intervals must be adhered to:

13.4.1 Prior to every dive

When assembling the equipment ensure in particular that all connections are free of impurities. If necessary, grease the O-rings. Do not use excessive grease. It is sufficient for the O-rings to exhibit a fine sheen. Check the correct function of the equipment in accordance with chapter 8.

- Defective and/or worn out parts must be replaced immediately.
- If the equipment is not fit for operation according to the checklist (chapter 8) then under no circumstances should it be used.

13.4.2 After every dive

Clean the equipment after every dive in accordance with chapter 11. It is necessary to carry out quick or complete cleaning depending on the situation. If the equipment has been used in seawater then it must be cleaned with freshwater before being disassembled for cleaning.

- Complete cleaning should take place shortly after the dive and no later than 12 hours afterwards.

13.5 Maintenance Intervals

The JJ-CCR Rebreather must be maintained in accordance with the maintenance intervals specified.

- The user is permitted to replace the O-rings for the breathing circuit, the lid, base plate, shutter valves, oxygen sensors and membrane for the ADV. The equipment must be returned to the manufacturer or an approved service centre for all other work.
- Maintenance and repairs to the solenoid, electronics and the first stage must be carried out by the manufacturer or an approved service centre exclusively.
- In the event of repairs only use original replacement parts. If other parts are used then the warranty is voided and there is a risk that a malfunction could result in injury or even death.
- The individual maintenance intervals are based on normal use. In the event of more intense use, these intervals must be reduced. It is therefore necessary to replace defective and/or worn out parts immediately, irrespective of the maintenance intervals.

13.5.1 Every 12 months

Part or Assembly	Maintenance Task
Oxygen sensors	Replace all three oxygen sensors if the production date is more than 12 months ago.
1st stage diluent 1st stage oxygen	Revision of the 1st stage for the diluent and the 1st stage for the oxygen.
Medium pressure hoses High pressure hoses	Check all medium and high pressure hoses
Breathing circuit	Replace all O-rings at the connections with the T-piece and ADV. This applies to the breathing hose with the DSV and the two breathing hoses from the lid.
DSV (Dive Surface Valve)	Exchange the shutter valves.

13.5.2 Every 24 months

Part or Assembly	Maintenance Task
Lid	Replace three O-rings (2 x lid seal, 1 x soda lime canister seal)
Base plate	Replace both O-rings
Diluent tank Oxygen tank	Carry out a pressure check / visual inspection of both tanks. It may be necessary to also observe the specific regulations applicable to the country of use.

13.5.3 Every 60 months

Part or Assembly	Maintenance Task
JJ-CCR Rebreather	Return the equipment to the manufacturer or an approved service centre for a general service.

ALWAYS KNOW YOUR PO2

THIS MANUAL IS PRODUCED BY JJ-CCR ApS.

WE ARE PROUD OF BEEING THE REBREATHER MANUFACTURER OF YOUR CHOICE!

OUR TEAM INTEND TO SUPPORT YOU AS MUCH AS THEY CAN IN ORDER TO EXCEED YOUR EXPECTATIONS